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AUTOPILOT NP2015/2025

Type 102-886 NG001

OPERATOR MANUAL

1 Description
2 Operating Instructions

Nautoguide B - track control (Autopilot with ECDIS) appended

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SAFETY REGULATION

▶ **Attention!**

For safety reasons, the preadjusted rudder limitation is also active during R.o.T control.

If the preadjusted rudder limitation is too small, then the preadjusted speed value will not be reached.

▶ **Note**

The desired rate of turn depends

- on the initial turning behaviour of the ship
- and on the adjusted parameters.

When the ship starts turning, the rate of turn may be increased up to approx. 50%!

▶ **Caution**

Turning behaviour with preset rudder limitation:

If the adjusted rate of turn is not reached due to rudder limitation, the rudder limitation is to be extended only step by step. (steps of < 5°).

Otherwise, the rate of turn might considerably be exceeded because of the integral component of the controller.

▶ **Note**

Set course inputs differing by more than ± 180° from the instantaneous heading of the ship are executed by NP2015/2025 through the shorter way as a matter of principle.

In case of a heading change of 180° exactly, therefore, the direction of heading change is uncertain!

▶ **Note**

If the autopilot is connected via the steering mode selector or via an external steering station, the main steering station is always switched to the operating mode of **Heading Control**.

SAVETY REGULATION

▶ **Attention!**
The values for R.o.T. or radius which are preset on the NP2015/2025 are overwritten by the external values (e.g. track planning system). After switching back to e.g. *Heading Control* , check whether the still-valid values for R.o.T. or radius provide for a safe heading- or track change!

▶ **Note**
Operating mode of **HEADING CONTROL**
If the magnetic compass values and gyro compass values are different, switching-over to the compass reference results in a preset heading adaptation.
Possible course differences between set course and heading remain in existence.

Operating mode of **TRACK CONTROL**
In this operation mode the actual heading may differ from the heading indication, depending on the track error.

▶ **Note**
Autopilot operation at high speeds.
(HSC High Speed Craft, according to IMO guidelines from 30kn to 70kn)
On pages HSC-1, HSC-2 and HSC-3 the behaviour rules for the following situations are documented:

1. **Sensor failures**
2. **Autopilot errors**
3 **Hazard when accelerating or changing course and in heavy seas**

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Annex:

Operation with HSC
Operator Unit
Summary of configuration

Quick Manual

Operator Manual No. 3677 “Natoguide B – track control

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1. Sensor failures

No.	Action	Effect	Operator Note	Reaction time
1	Failure of the log	A failure of the log is sensed and announced optically and acoustically on the control unit as Spd Ref. Missing. The last valid speed value is frozen and is used from then on as a valid speed for setting the regulator. Valid for speeds > 5 knots.	Switch over the log to manual speed input.	The reaction time – switching over to manual input – is not critical as long as the speed is to be maintained.
2	Error in the heading reference	A heading reference failure is sensed and announced optically and acoustically on the control unit as *Gyro Ref. Missing*. The last valid actual course is frozen and is used from then on as the heading reference. The set course should be the same as the actual course in order to prevent any rudder reaction. It is no longer possible to set a course on the control unit.	a) Reduce the speed to values < 20 knots. Switch over to the magnetic compass or to the second gyrocompass, if one is available. Optimize the control parameters during magnetic compass operation if stable regulation is not available. b) Switch over to manual control and use a second heading reference that is not subject to errors.	If it is necessary to make a maneuver, it is necessary to switch over immediately to manual control.

2. Autopilot errors

No.	Action	Effects	Operator Note	Reaction time
1	System error / Power down	The autopilot can no longer be used in the case of a system error. The effects cannot be described accurately in each case. The aim is to bring the rudder position into the centre position. A system error is announced optically and acoustically on the signal unit.	Switch over to manual control. Reduce the speed so as to be able to better control any possible rudder equalization operations.	The reaction time – switching over to manual control – is critical. It is necessary to switch over at once.
2	Error in the control unit	A control unit error in the form of an electronics failure has no effect on the current controller behavior. The operator notices that the control unit can no longer be used because nothing is shown on the display or else sees the *No Connection* or *No Telegram* message.	Switch over to manual control, since it is not possible to make any more heading settings and there is no further control over the autopilot (warnings, alarms, parameter settings).	The reaction time – switching over to manual control – is not critical

3. Hazard when accelerating or changing course and in heavy seas

No.	Action	Effects	Operator Note	Reaction time
1	Acceleration of the ship	Automatic adaptation of the controller to the speed is especially important during acceleration. A missing log (e.g. errors) can cause controller instability and unpleasantly larger rudder angles.	If it is not possible to ensure a log function, the ship must be accelerated slowly to the desired speed and the speed input made manually. Rudder limiting should be set to the maximum permissible value.	Switch over immediately to manual control in the event of controller instability.

No.	Action	Effect	Operator Note	Reaction time
2	Change of heading	Changes of heading are to be done such that any unacceptably high centrifugal acceleration is avoided (< 0.05g). This reduces the risk of accidents to the passengers and any shifting of loads. Computed relationship: a = d*v a = acceleration (centrifugal acceleration) b = turning speed when changing heading v = travelling speed You can see that the turning speed and the travelling speed have a proportional effect on the acceleration. The turning speed must be selected in relation to a desired maximum speed such that the acceleration rates described above are not exceeded. Turning speed limiting can be set at the autopilot.	Determine the maximum permissible turning speeds for various travelling speeds (depending on the passengers and the load). Determine the maximum amount of rudder limiting.	It is necessary to reduce the travelling speed at once if there is excessive centrifugal acceleration.
3	Sea	a) The speed of the ship must be matched to the current sea conditions. This determination must be made in connection with the ship safety regulations. (Wave height and maximum permissible speed) b) The effects of heavy seas can also cause undesirably high rudder amplitudes with the autopilot.	Increase the yawing setting until a compromise is reached between rudder action and heading accuracy for a travelling speed that is still permissible.	In the case of impermissibly large rudder movements it is necessary to reduce the travelling speed for safety reasons. Then check the yawing setting.

1 Description

1.1 General

The NP2015/2025 belongs to the digitally adapted Autopilot family **NAUTOPILOT2000**.
The NP2015/2025 is a modern autopilot system, designed for all sizes of sea going ship and for river navigation.
The essential components of the NP2015/2025 are:

- Operating Unit 102-886
- Control Unit 102-885

The NP2015/25 offers two operating modes, which after a request takes an individual course- or supports the already adjusted and loaded track control (adjustment of ships load only for NP2025).

- Optimal heading- or track control over the **Quick Tune** Function.
  Quick Tune makes the adjustment and storing possible from up to 6 Parameter-groups which can through certain ships typical situation (Loading, Trim) or weather conditions be brought back.
  Aim; quick adaption to the ships behaviour by manual operation.

- **<u>Only for NP 2025</u>**
  Optimal heading -or track control over the **Economy** or **Precision** Function.
  Within this Function the NP2025 reacts automatically to the current weather conditions.
  The operating mode **Economy** guarantees a satisfying reduction to the rudder movement through a reliable remaining course position.
  On this occasion the swell frequencies are standardized through a special filter.
  Aim; Automatic reduction of the rudder movement, means a slight forward thrust loss and with that less fuel.
  The operating mode **Precision** guarantees an exact course position.
  The Rudder movement will be notably reducedb yusing the yawing settings.

The NP2015/2025 enables the following operating modes.

- heading control with gyro compass
- heading control with magnetic compass
- heading control in connection with a track planning system (e.g. GPS)
- change of heading with preset R.o.T.
  change of heading with preset radius
- rate-of-turn control in conjunction with a R.o.T. Tiller

- heading control with an external preset heading transmitter

The NP2015/2025 system is put together from the following components

- 1 Control unit as a main control panel

  - Optional System extension through the continuation of the NP2015/2025 control unit e.g. a second control panel is possible

- 1 Control Unit
  depending on the inserted universal target- respectively expandable as for example:

  - NP2015/2025 as a self dependent system
  - NP2015/2025 in connection with an external follow-up control
  - NP2015/2025 as a combination of an autopilot system a gyro compass system STANDARD 20 Plus.

- Repeater Raytheon Marine in various types.

1.2 Operating Modes

1.2.1 Heading Control Operation

The HEADING CONTROL operating mode is activated by changing the control switch to **AUTO**.

The momentary heading of the ship is displayed in the heading display and in the preset heading display.

The preset heading preadjustment is set via the rotary knob. The heading controller begins with the change of heading within the range of the preset parameter values (such as, e.g. radius- or R.o.T. limit value) and the alarm threshold (heading failure, rudder limitation).

The heading reference - magnet compass or gyro compass - is selected via the operating unit. Compass value deviations are recognized.
An existing preset heading / heading deviation is taken into account when switching over. This results in a preset **heading adaptation**.

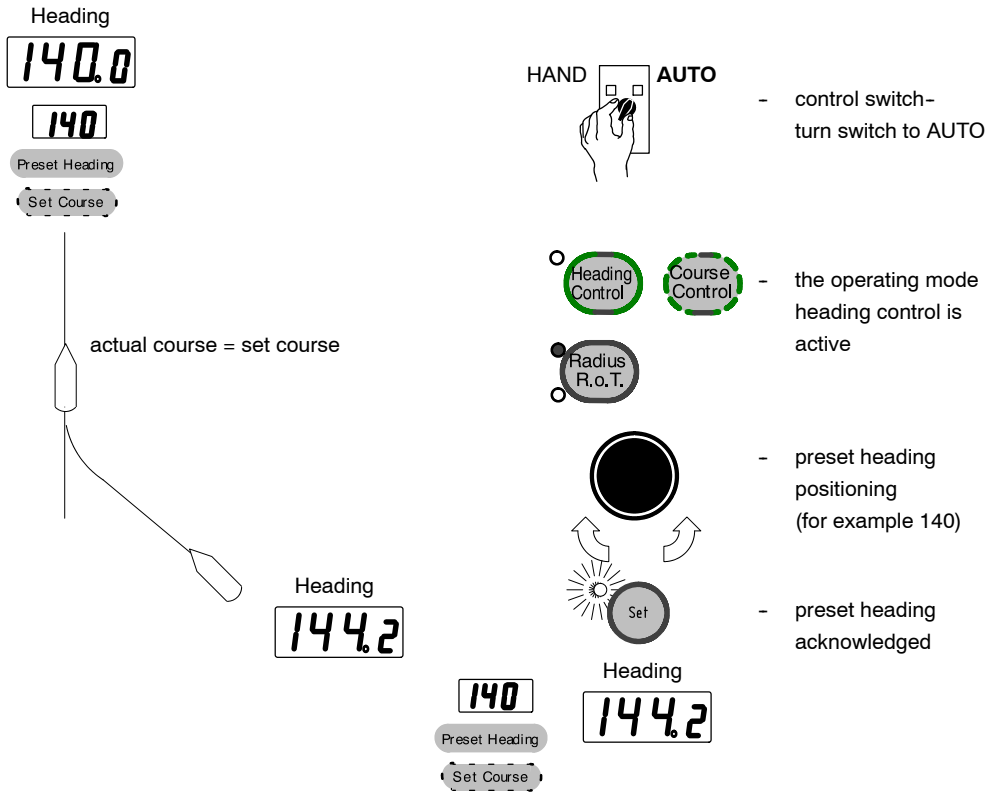


Fig. 1-1: Heading control after manual heading preadjustment

1.2.1.1 Parameter Yawing, Rudder and Cnt. Rudder

Yawing

The yawing setting determines rudder activity and course accuracy for the autopilot's control properties.

The optimum setting is obtained by means of observation.

Yawing = 1 signifies control with greatest amount of activity (maximum accuracy level).

Yawing = 6 signifies control with the lowest amount of activity (minimum accuracy level).

If the setting is not optimised the steering gear can become over-stressed. Large rudder angles cause loss of saeway.

Rudder

Each course deviation needs to be corrected by means of a rudder size typical to the ship. The rudder setting determines the ratio of rudder angle to course error.

Rudder too big:

- Unstable behavior => over-reacts to a course correction
  => Overshoots when course is changed

Rudder too small:

- Course control too inaccurate
  => preconfigured rotation speed not reached during course change manoeuvre

Cnt. Rudder

Based on its bulk and load, each ship has a time constant typical to the ship, which needs to be kept in control during course change manoeuvres.

Before the new set course is reached to the turning speed needs to be reduced in good time (e.g. of a counter rudder).

This effect is achieved by the counter rudder setting (Cnt.Rud).

Counter rudder too high:

The ship is stopped before it reaches the new set course.

Counter rudder too small:

The ship does not stop in good time and overshoots the pre-selected set course.

1.2.1.2 Heading preadjustment more than 180°

There are two different possibilities to adjust the heading preadjustment.

1.Preselected Heading

Heading adjustment und acknowledgement of the adjusted value by the Set-key. In this mode the ship follows the respective heading adjustment within a range of 0 to 359,9°. It means, there will be an all-around circle.

For example: Actual heading is 270°.

New heading will be 280°.

Direction of roation should be Port.

The new heading will be 280° after a around circle of 350° with a direction of rotation to port.

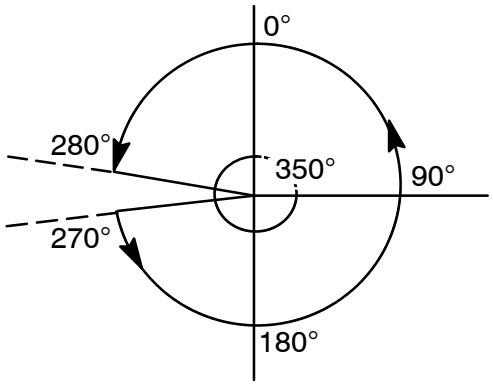


Fig. 1-2 Direction of rotation of the preselected heading

2. Direct heading

The rotary knob has to be pushed-in while the heading value is adjusted. In this mode the ship follows at once the new value and a change of heading can be more than an all-around circle.

Caution: In case of a malfunction, it means a heading-jump with an adaption to the new heading value, the initialized heading-change-maneuovre will be aborted.

1.2.2 Operation with a Pre-Switched External Preset heading Transmitter

ATTENTION

This mode can only be performed with an external navigationsystem.
The system application “Autopilot (REMOTE)” is only allowed under use of an approved track control system.

The preset heading preadjustment is determined here by the navigation system and transmitted to the NP2015/2025 via a serial interface.
The **EXTERNAL** status display lights up.
The NP2015/2025 executes the heading control within the range of the parameter preadjustments.
The mode REMOTE has to be activated by the contact on terminal board L2.47 and L2.48 (see service manual Annex 1-4).

During this operating mode, the following characteristics of the NP2015/2025 operation are not available:

- switching over to another operating mode (e.g., track control)
- consideration of preadjusted radius or R.o.T-values of the NP2015/2025, as these values are deleted and replaced by external values,
- preadjustment of the preset heading via the rotary knob

1.2.3 R.o.T. Tiller Operation (Option)

This system concept simplifies steering and makes turning manoeuvres of the ship easier on rivers and canals.
The rate of turn of the ship is set by pressing the R.o.T Tiller.
The preset heading and the actual heading are identical.

The R.o.T. controller in the NP2015/2025 then determines the rudder angle necessary to attain and hold the preadjusted R.o.T.

ATTENTION

For safety reasons, the preadjusted rudder limitation is also active during R.o.T control
If the preadjusted rudder limitation is too small, then the preadjusted speed value will not be reached.

The control dynamic of the R.o.T. controller can be adjusted via the YAWING parameter:

YAWING 1	= >	hard controller adjustment
YAWING 2	= >	normal controller adjustment
YAWING 3....6	= >	smooth controller adjustment

During this operating mode, function key

(used in setting the limit value) is deactivated.

1.2.4 Track Controller Operation (Option)

The track control operating mode requires the connection of a navigation receiver (e.g. GPS) to the NP2015/2025.

ATTENTION

Track controller operation is only allowed under use of an approved track control system.

Within this system concept, the navigation receiver transmits track section data of a planned route (APB, APA, PRAPA, HSC NMEA Telegr.) to the NP2015/2025. Every track section is shown as a preset track course (preset heading display) and carried out after a corresponding operation routine.

A track course change is carried out using the preadjusted R.o.T. (or Radius).

The track course trim characteristic of the NP2015/2025 compensates for a drift, which can occur due to strong winds or currents (see section 2.6.4.1).

A route can only be planned via the navigation receiver (see manufacturer's handbook).

In case of navigation receivers where the track section data is displayed but where this data is not valid as a track course preadjustement for the NP2015/2025 (XTE NMEA Telegr.), another mode of operation results for the NP2015/2025.(see section 2.6.4)

Here, the new track course must first of all be read out from the navigation receiver. The track course value must then be set on the NP2015/2025 operating unit using the rotary knob and and subsequently acknowledged with the **Set** key.

1.2.4.1 Features of NP2015/2025 Track Control

- To approach a track
  Before changing the operating mode make sure
  - that the approximate heading position to the next track section is $\alpha \leq 60°$
  - that the ship is within the track monitoring limits

  To approach the track, the heading control operating mode of the NP2015/2025, or manual steering, is recommended.

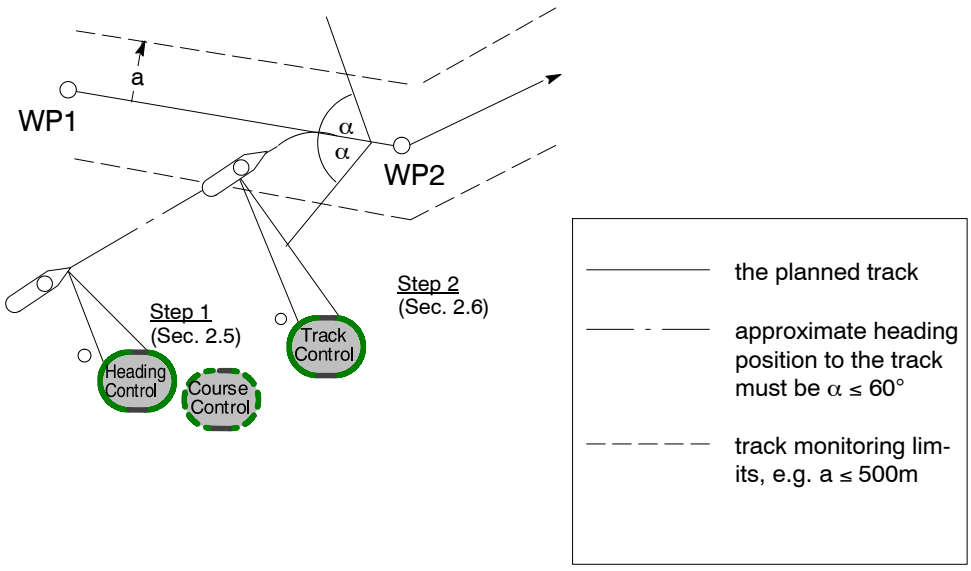


Fig. 1-3: Approaching a Track

- Track change (for APA, APB, PRAPA, HSC, HTR, HRA, NMEA Telegr.)
  (HSC, HTR and HRA only for REMOTE operation).
  A new track course is transmitted via the navigation receiver to the NP2015/2025 and displayed in the text line.
  At the same time, an acoustic signal sounds in the NP2015/2025 control unit.
  The LED of the Set key flashes, thereby requesting an acknowledgment of the new track course setting.

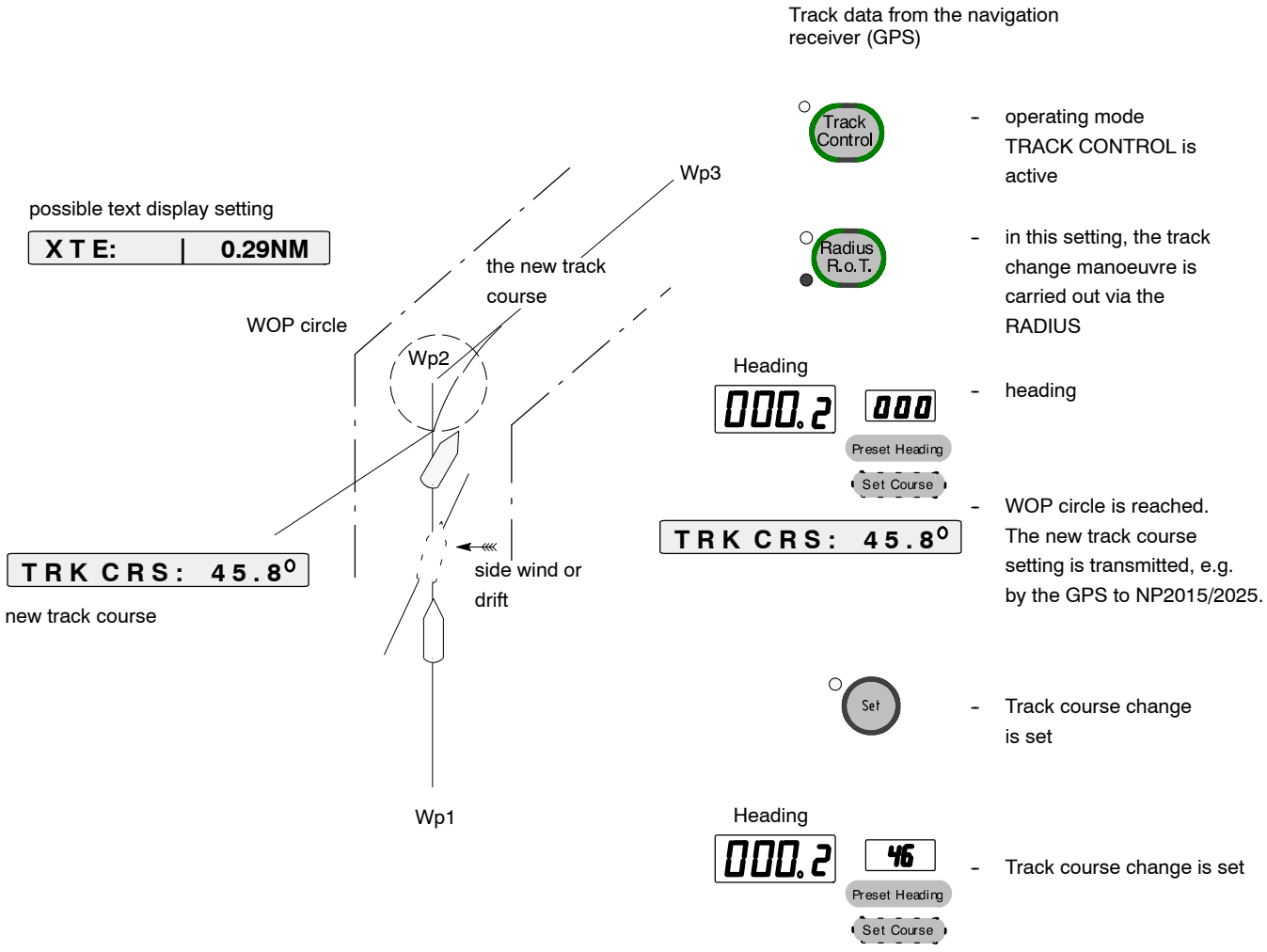


Fig. 1-4: Track Change

- Examples of possible track change manoeuvres with preset Rate of Turn.

  Definition: The Wheel-Over-Point (WOP) is where the start into the new track (with track course at Ψ_B) with the preadjusted R.o.T. begins
  The Wheel-Over-Point is determined by the navigation receiver, (see manufacturer's handbook).

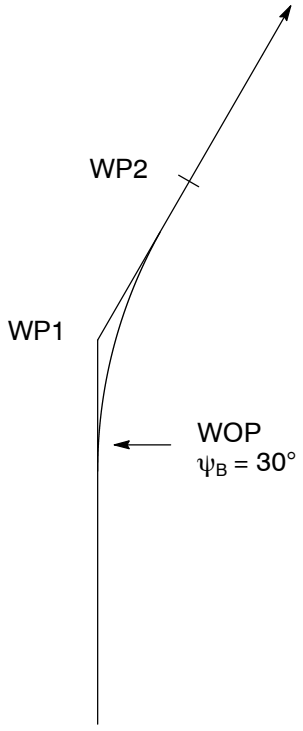


Fig. 1-5: Track course change at a small angle

In the following qualitative examples, various track change manoeuvres at variable rates of turn are shown.
Here it becomes clear that the track deviation increases significantly in case of a low preset rate off turn.

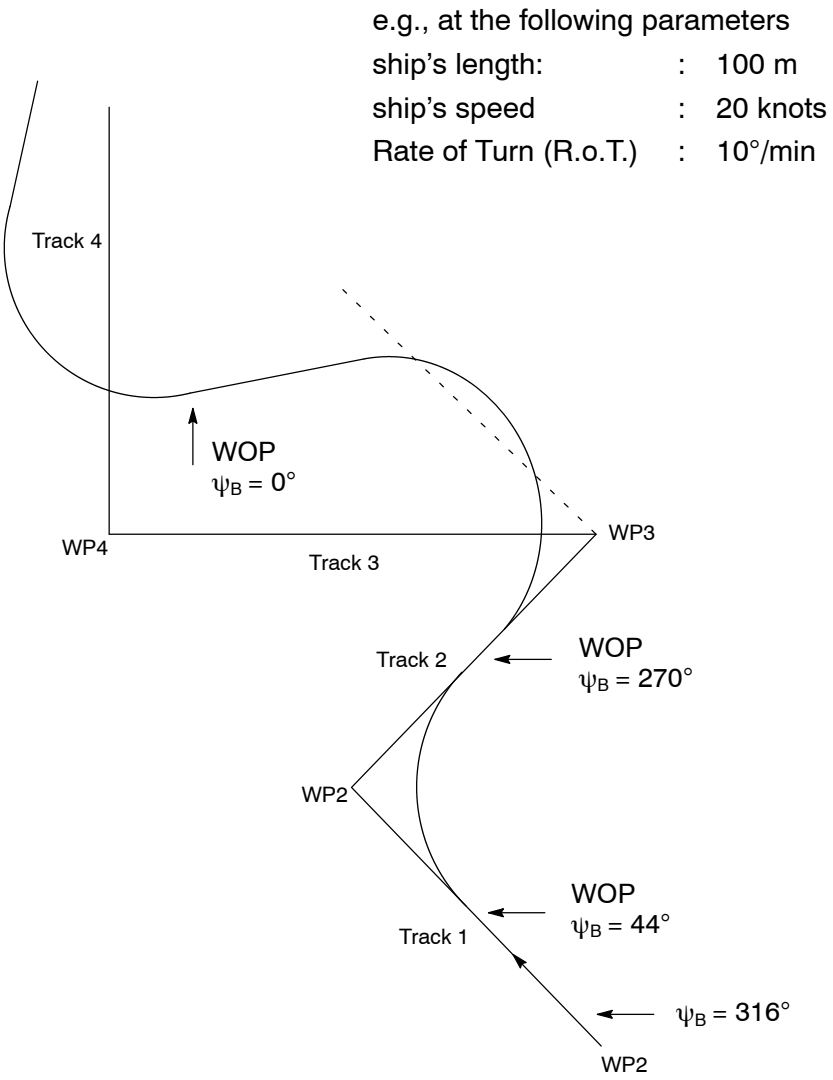


Fig. 1-6: Track change at a Rate of Turn of 10°/min

e.g., at the following parameters

ship's length		:	100 m
ship's speed		:	20 knots
Rate of Turn	(R.o.T.)	:	30°/min

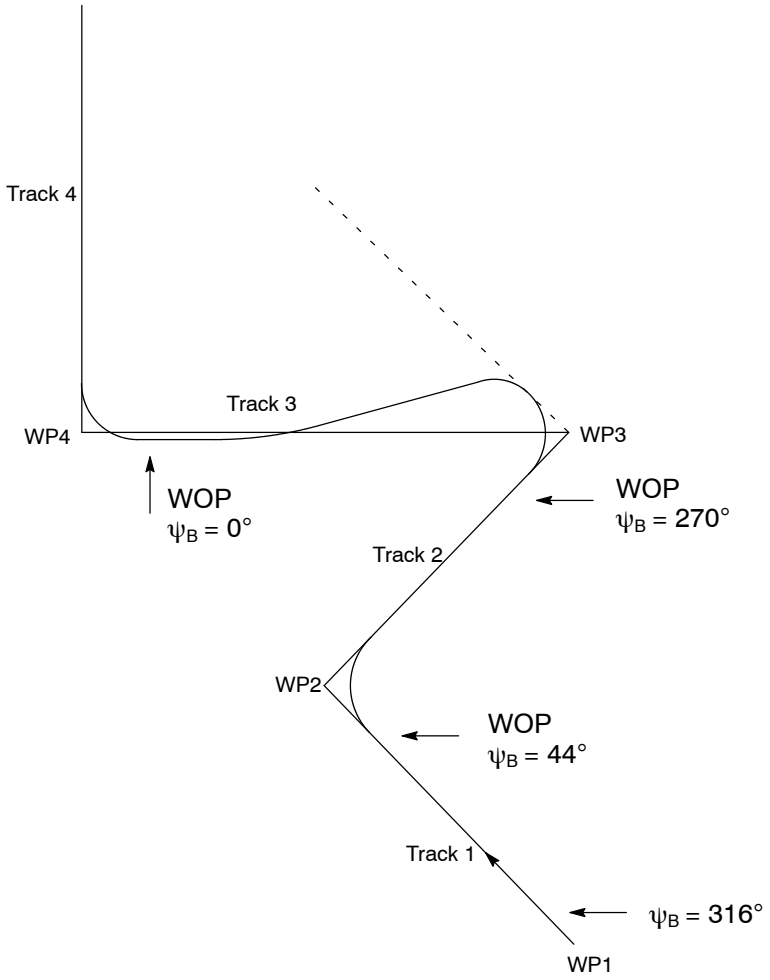


Fig. 1-7: Track change at a turning speed of 30°/min

e.g., at the following parameters

ship's length		:	100 m
ship's speed		:	20 knots
Rate of Turn	(R.o.T.)	:	60°/min

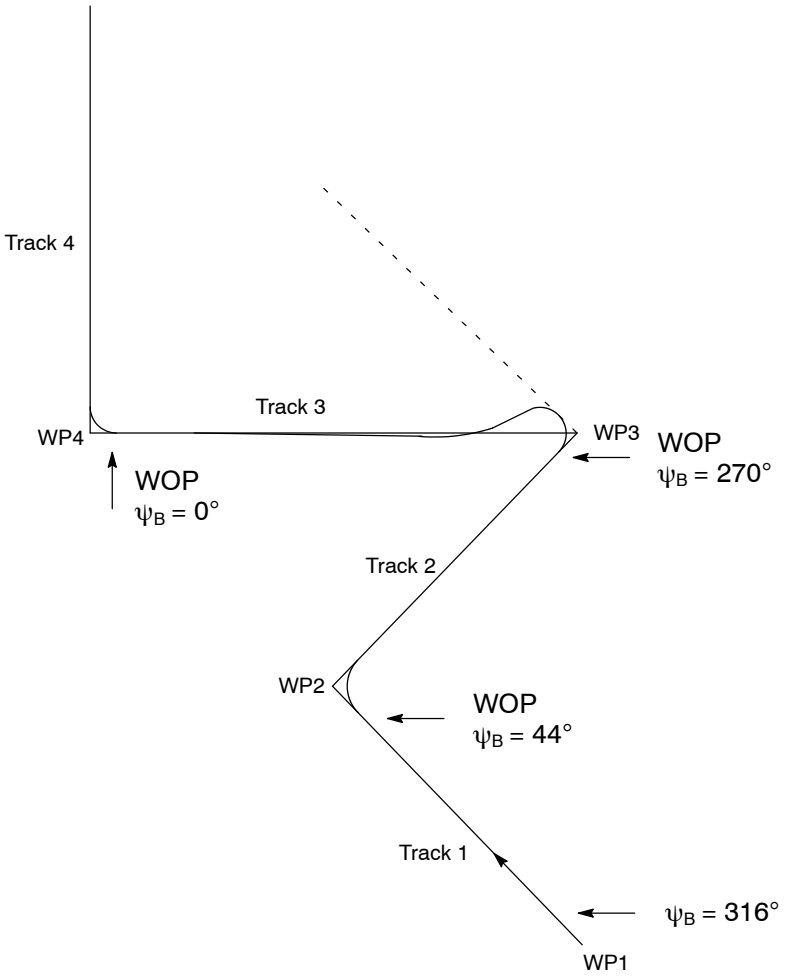


Fig. 1-8: Track change at a turning speed of 60°/min

The following illustration shows the performance of the track controllers when a sudden drift causes the ship to go off track.

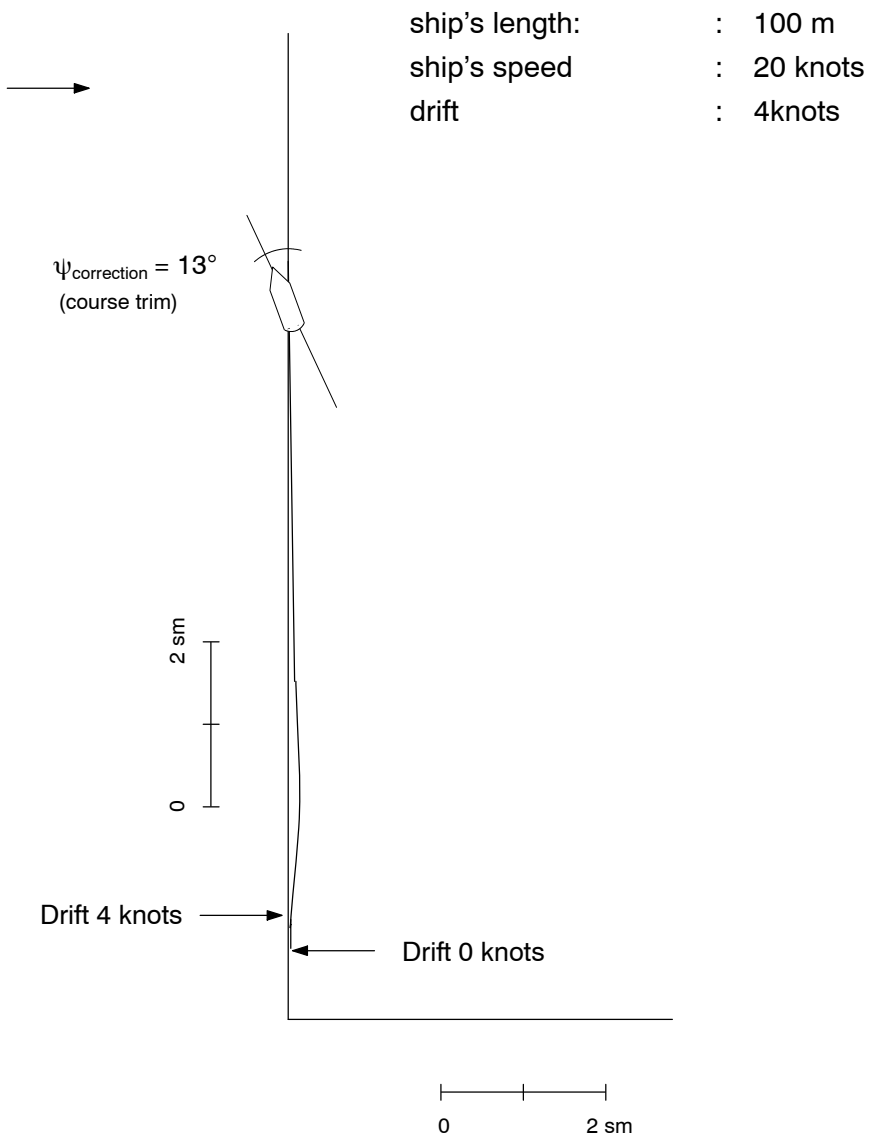


Fig. 1-9: Track control during a sudden drift.

2 Operating Instructions

2.1 General

The NP2015/2025 has the following standard operating features:

- Heading control in consideration of a radius or R.o.T. limit value adjustment
- Track control in consideration of a radius or R.o.T. limit value adjustment (in conjunction with a track planning system or navigation receiver)
- Rate-of-turn control via an R.o.T. tiller
- REMOTE operation (in conjunction with a serial preset heading transmission system)

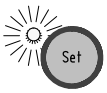
The intended operating mode can be called up via command keys.
The REMOTE operation is to be selected from an external position only.

On selecting an operating mode, all necessary sensor data is checked for plausibility. Additional LEDs in addition to the commando keys indicates the active operating mode. In case of disturbance, an error message in plain text appears in the alphanumeric line. Operator inputs are possible only when the alarm has been acknowledged.

Function keys permit calling up and varying parameters, sensors and permanent information indication within the text line.
The adjustments selected for this purpose are applicable to all **NP2015/2025** operating modes.

2.1.1 Explanation of Used Symbols

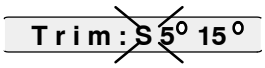
Key actuation



LED *flashing*

LED *out*

LED *on*



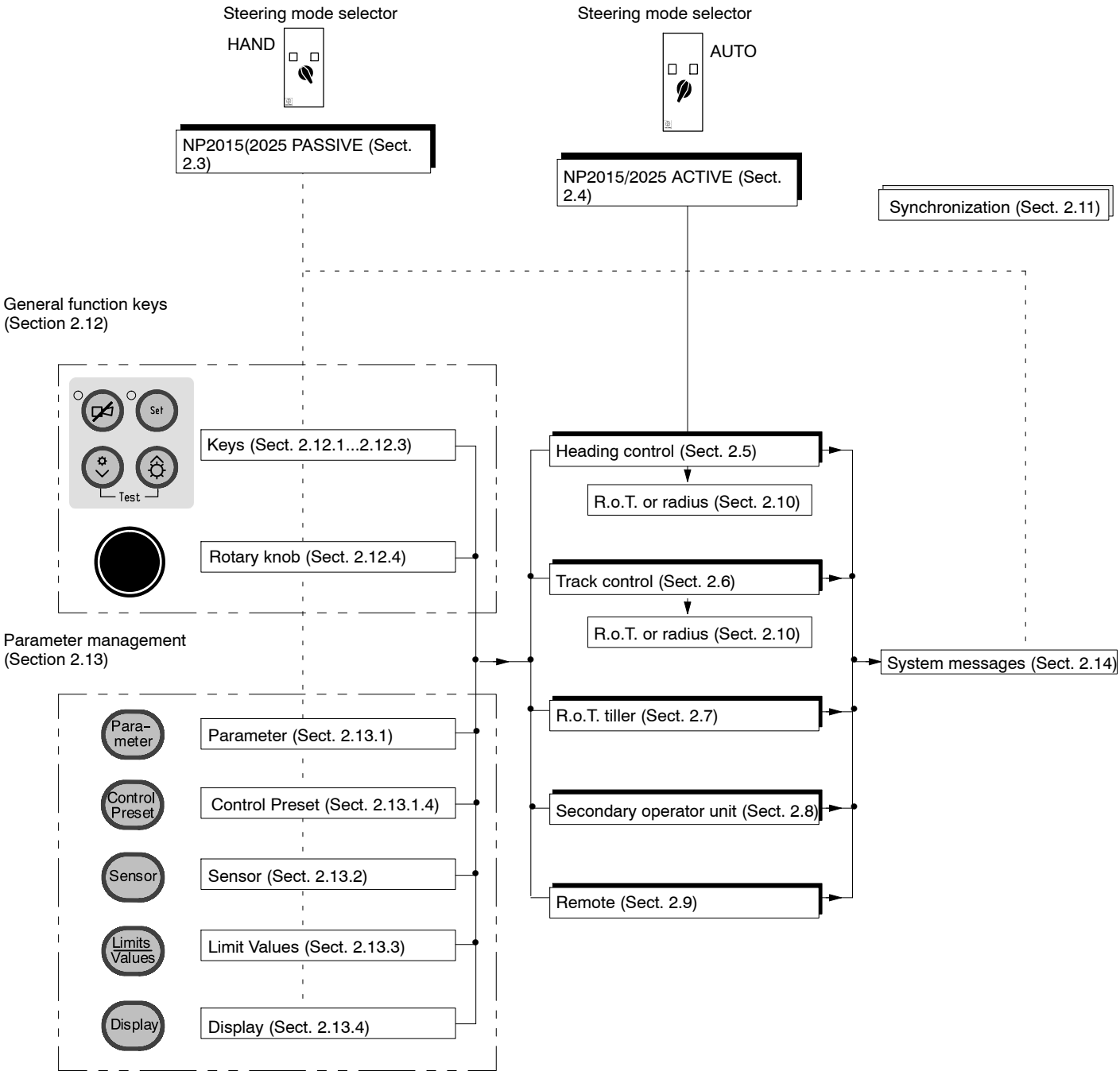
Actual parameter flashing

Audible signal *on*

Audible signal *off*

Rotary knob pressed

2.1.2 Survey of Operations



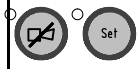
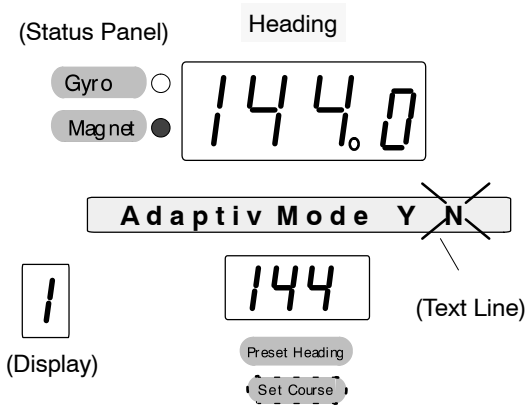
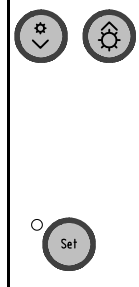
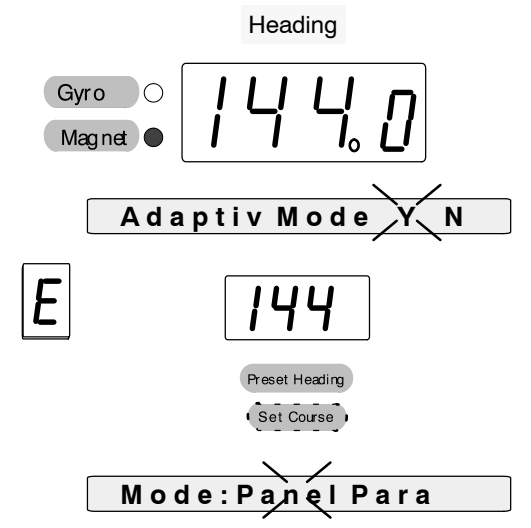
2.2 Selecting the Individual Mode of Operation (Economy/Precision or Basic) (only NP2025)

This individual selection can be made before or during the journey.

If, during the journey, you want to switch from **Basic** to, e.g. **Economy mode,** then the NP 2025 switches slowly to this mode of operation.

The reasons for this are:

- typical control behavior
- the ship's inertia

	Indications	Comment/Notes
1 Calling up the Configuration Selection Menu		
		Press both keys for approx. 4s simultaneously. The following request is displayed on the text line: Y ⇒ ***ECONOMY / PRECISION*** N ⇒ ***BASIC*** Note: The configuration selection menu is immediately quit by pressing a function or command key. Changes in the configuration are not accepted.
2 Selecting the Desired Mode of Operation		
		The setting changes from N to Y by pressing a key. The current setting flashes on the cursor. The display shows the current mode after acknowledgment pf the required setting. E ⇒ ***ECONOMY*** P ⇒ ***PRECISION*** ..6 ⇒ ***Parameter Group (Basic)*** The following request appears on the text line: Panel ⇒ Operator unit configuration Para ⇒ System configuration

	Indications	Comment/Notes
3 Quit Configuration Selection		
Course Control Heading Control	Heading Gyro Magnet RESTART 1 Preset Heading Set Course	A *RESTART* is automatically triggered by pressing a function key or command key. Subsequently, the last device setting is set with the operating mode selected in Point 2.

2.3 NP2015/2025 - PASSIVE - (Steering Mode Selector in Position HAND)

The NP2015/2025 has been separated from the steering control system by means of the steering mode selector.

The operator unit now acts as a display unit for

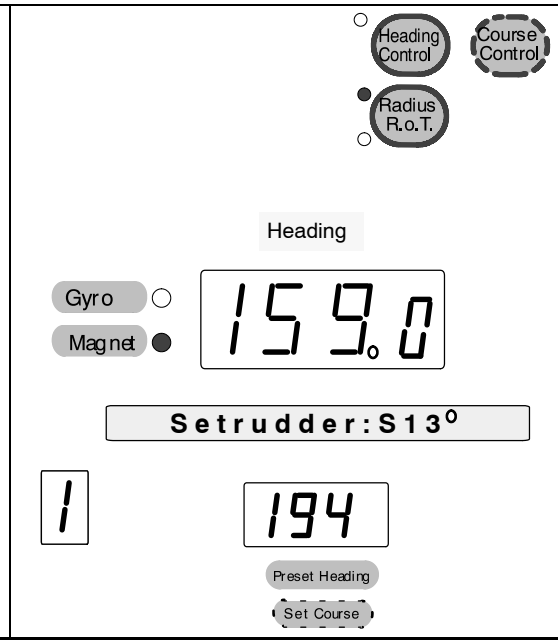
- heading
- for indicating the connected sensors and their status
- and permits various configuration adjustments via the function keys (see Section 2.13).

	Indications	Comment/Notes
1 Setting the steering mode selector to position HAND		
HAND	(Status field) Heading Gyro ○ Magnet ● 144° OFF 1 (Display) 144 Preset Heading Set Course (Text line)	The current NP2015/2025 operating mode is no longer valid. The functions of the command keys are cancelled. The preset heading is made to follow up the heading. The status of the heading sensor remains displayed. Within the text line, the status of the NP2015/2025 equipment is permanently displayed. The last parameter group number remains indicated. Settings such as (see Section 2.13) - parameter management - display management, or the - dimmability of the key and display illumination remain possible. Possible sensor failures (compass, log etc.) are signalized by flashing of the symbol key LED (see Section 2.14) . Alarms are not indicated via the text line (no audible signalling).

2.4 NP2015/2025 - ACTIVE - (Steering Mode Selector in Position AUTO)

The Autopilot NP2015/2025 is connected to the steering control system via the steering mode selector.

	Indications	Comment/Notes
1 Setting the steering mode selector to position **AUTO**PILOT NP2015/2025		
AUTO	(Command keys) Heading Control, Course Control, Radius R.o.T. (Status field) Heading Gyro ○ Magnet ● 144.0 Setrudder: 0° 1 (Display) 144 (Text line) Preset Heading Set Course	The **NP2015/2025** is automatically switched to operating mode *Heading Control* (LED lights up). The last limit value adjustment for R.o.T. or radius is active. The current heading is adopted as preset heading presetting. The heading sensor status is indicated. The last info text with a current indication appears in the text line. The operating mode can be changed at any time.
2 Preset heading preselection (see also section 1.2.1.2 “Heading preadjustment more than 180°”)		
	Heading Control, Course Control, Radius R.o.T. Heading Gyro ○ Magnet ● 144.0 PRESELECTED CRS 1 194 Preset Heading Set Course Set	Turning the rotary knob results in that another preset heading appears within the **Preset Heading** display (Rotary Knob Adjustment see Section 2.12.4). A comment appears within the text line (for approx. 15s). The previous text is overwritten for this period. The LED of the **Set** key is flashing. The new preset heading must be acknowledged within approx. 15s. After that, the previous,still valid preset heading appears on the **Preset Heading** display.

	Indications	Comment/Notes
3 Acknowledging the preset heading preselection (see also section 1.2.1.2 “Heading preadjustment more than 180°“)		
Set		The ship starts the change of heading. The change of heading is executed with regard to the limit value adjustment for R.o.T. (see Section 2.13.3). Within the text line, the current set rudder position can be followed. System messages see Section 2.14. The change of heading is completed as soon as the heading corresponds to the preset heading preselection. The operating mode can be changed at any time.

2.5 Operating Mode of Heading Control

After being activated the Autopilot NP2015/2025 is automatically switched to the operating mode of heading control.

The preset heading equals the heading.

- Prepared heading change

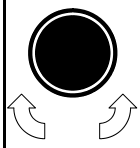
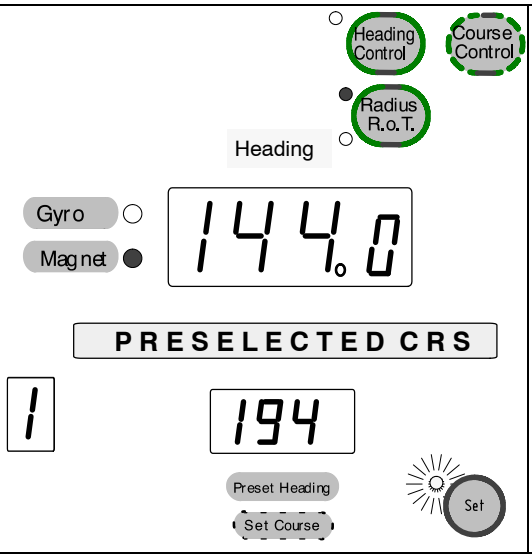
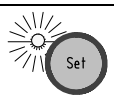
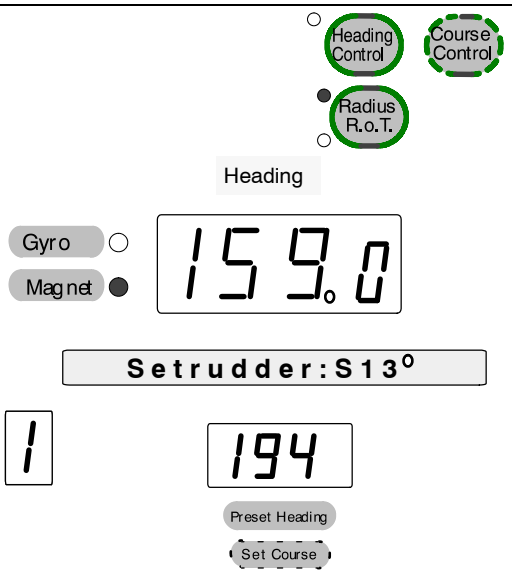
  Pre-condition:

  - Steering mode selector in position **AUTO**

NOTE

Preset heading inputs differing by more than ± 180° from the instantaneous heading of the ship (see section 1.2.1.2 Heading preadjustment more than 180°).

	Indications	Comment/Notes
1 Switching on the operating mode of heading control		
Heading Control Course Control	Radius R.o.T. Heading Gyro Magnet 144.0 Setrudder: 0° 1 144 Preset Heading Set Course	The preset heading equals the heading. The last limit value adjustment for e.g. R.o.T. remains valid. The parameter adjustments remain valid. The ship is held on the preset heading.

	Indications	Comment/Notes
2	Preset heading preselection (see also section 1.2.1.2 Heading preadjustment more than 180°)	
		Turning the rotary knob results in that the desired preset heading appears within the **Preset Heading** display (rotary knob adjustment see Section 2.12.4). A comment appears within the text line (for approx. 15s). The previous text is overwritten for this period. The LED of the Set key is flashing. The new preset heading must be acknowledged within approx.15s. After that, the previous, still valid preset heading appears again on the **Preset Heading** display.
3	Acknowledging the preset heading preselection (see also section 1.2.1.2 Heading preadjustment more than 180°)	
		The ship starts the change of heading. The change of heading is executed with regard to the limit value adjustment for R.o.T. (see Section 2.13.3). Within the text line, e.g. the current set rudder position can be followed. System messages see Section 2.14. The change of heading is completed as soon as the heading corresponds to the preset heading preselection. The operating mode can be changed at any time.

2.5.1 Parameter Yawing, Rudder and Cnt. Rudder

While adjusting the parameter value a temporary parametergroup is created:

Yawing determines the Yawing variations and so the accuracy of heading control.

Rudder determines the proportionally amplification of the heading controler.

Cnt. Rudder determines the differential part of the heading controller with respective effect of meet of the helm.

2.6 Operating Mode of Track Control

ATTENTION

Track control is only allowed under use of an approved track control system.

2.6.1 General

The operating mode of track control requires an external track planning system or a navigation receiver. Within this system conception, the track planning system sends available track section data of a route (APB, APA, PRAPA, HSC, HTR, HRA, NMEA Telegr.) (HSC, HTR and HRA only for REMOTE operation).

- Management of various data telegrams
  The NP2015/2025 and the connected navigation receiver must be adjusted for the same telegram type (see Service Manual 1.5.1.1).
  See System Manual of the Navigation Receiver -Telegram Specification-.
  Within the **NP2015/2025** operation, 2 different telegram-specific sequences of operation take place:
  - Operating mode of track control making use of the **XTE** NMEA telegr. transmission (no track course transmission)
  - Operating mode of track control making use of the telegram types such as **APB, APA, PRAPA, HSC, HTR, HRA and NMEA** telegr. (HSC, HTR and HRA only for REMOTE operation).

- Approaching a track
  Before changing the operating mode make sure that
  - the heading with regard to the track (WP) $\alpha \leq 60°$
  - the ship is within the track monitoring limits (for adjustment of track monitoring limits see Section 2.13.3).

  It is recommended to approach the track via heading control by NP2015/2025 or via manual control.

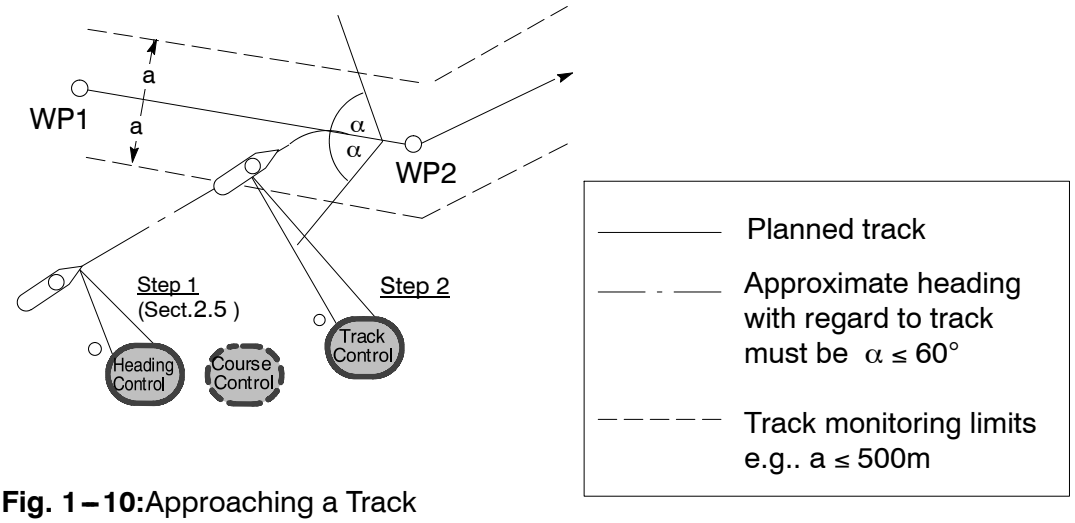
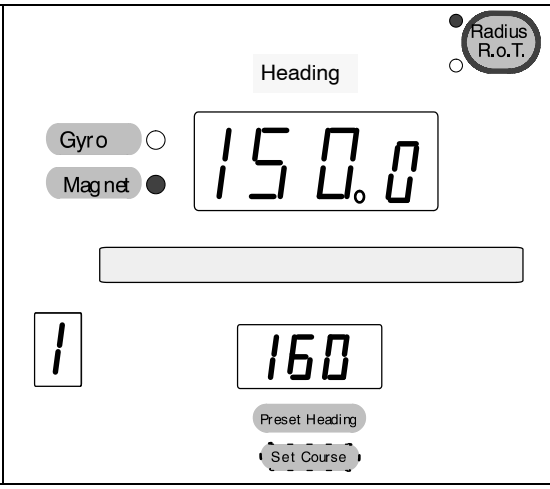
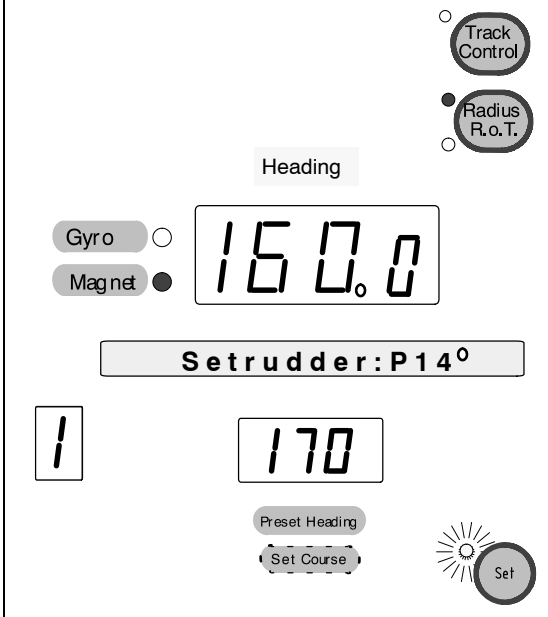


Fig. 1 – 10: Approaching a Track

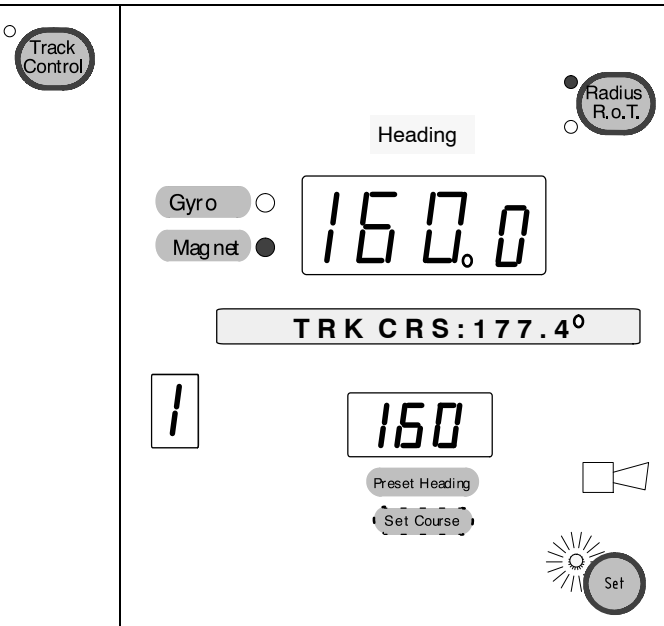
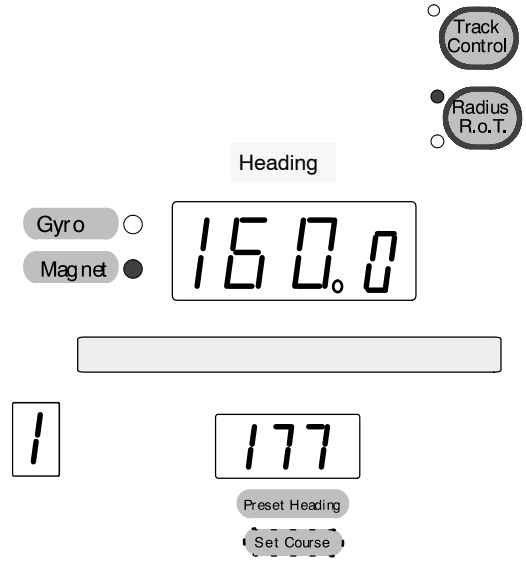
2.6.2 Operating Mode of Track Control (XTE NMEA Telegr.)

	Indications	Comment/Notes
1 Switching on track control		
Track Control		By actuation of the key, the switch-on conditions are checked (see Section 2.14). Compare the current preset heading with the track course preselection planned on the navigation receiver (e.g. 170°).
2 Adjusting the track course preselection on the NP2015/2025		
		The track course preselection (e.g. 170°) is to be adjusted as preset heading preselection via the rotary knob. The flashing LED indicates the data take-over to be acknowledged. The new preset heading must be acknowledged within approx. 15s. After 15s, the previous, still valid preset heading adjusts itself on the **Preset Heading** display.

	Indications	Comment/Notes
3 Acknowledging the track course preselection		
Set		The change of heading starts with the preset rate of turn. Possible alarms see Section 2.14. With this display adjustment (see Section 2.13.4) the track deviation can be indicated on the left or on the right of the track.

2.6.3 Operating Mode of Track Control (with APA, APB, PRAPA, HSC, HTR, HRA NMEA Telegr.)

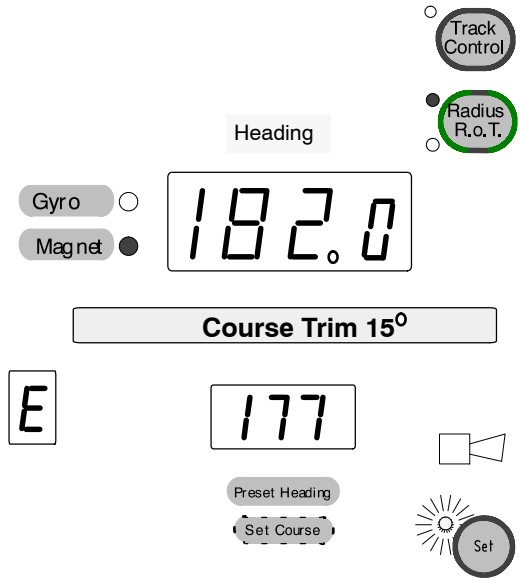
NMEA telegram for track-operation: APA, APB, PRAPA
NMEA telegram for REMOTE-operation: HSC, HTR, HRA

	Indications	Comment/Notes
1 Switching on track control		
Track Control		By actuation of the key, the switch-on conditions are checked (see section 2.14). Within the text line, the transmitted track course is indicated. Audible signalling. The flashing LED indicates the data take-over to be acknowledged. The rotary knob is without function.
2 Accepting the track course preselection		
Set		The change of heading starts. Possible alarms see section 2.14.

2.6.4 Situation during Track Control

2.6.4.1 Lateral-acting Drift Effects during Track Control

The navigation receiver (e.g. GPS) senses e.g. a laterally-acting drift and passes it on to the track controller.
The track-controller compensates the effect of lateral-acting drift.
The selected Course Trim value determines the control range of the track-controller.
As a possible Course Trim value a control range of min. 5° to max 30° can be adjusted.

	Indications	Comment/Notes
1	Proposal of Course Trim extension	
		The automatic range of correction is exceeded because of an increasing disturbance. Within the text line the alarm Course Trim displayed (extension see Section 2.13.3). Audible signalling is heard. The flashing LED indicates an extension proposal to be acknowledged.

2.6.4.2 Back-Up Navigator Alarm

The Back-Up Navigator Alarm is only used for a separate signal unit. The signal unit must be linked with the Autopilot.
The Back-Up Navigator Alarm occurs;

- when a used sensor is off and this alarm is not acknowledged on the bridge units (e.g. Autopilot, Nautoalarm)
- when Track Control is aborted and is not acknowledged
- when a message, which announces a track change manoeuvre is not acknowledged
- when a message, which announces a track end is not acknowledged

2.6.4.3 Track Change with Track-Heading-Transmission (only with APA, APB, PRAPA NMEA Telegr.)

The information on a track change to come is sensed via the navigation receiver and transmitted to the Autopilot NP2015/2025.

The track change is executed with the preselected R.o.T. or via a preset radius (see Section 2.10).

	Indications	Comment/Notes
1 Track course preselection		
		The forthcoming track change maneuver is, in this example, executed via a preselected R.o.T. (see Section 2.13.3) The next track course appears automatically in the text line. Audible signalling is heard continuously. The next track course appears automatically in the text line. The flashing LED indicates the track course to be acknowledged.
2 Initiating the track change		
Set		The track change starts. Possible alarms see Section 2.14. Within the text line, the last info line appears.

2.7 Operating Mode of Rate-of-Turn Tiller - R.o.T. controlling-

The operating mode requires an external R.o.T. tiller.
This mode has to be set in the service mode (see service manual Annex 1-2 ROT Tiller Yes/No).
The desired rate of turn is preset by the tiller, and the ship's rate of turn is held via the NP2015/2025.

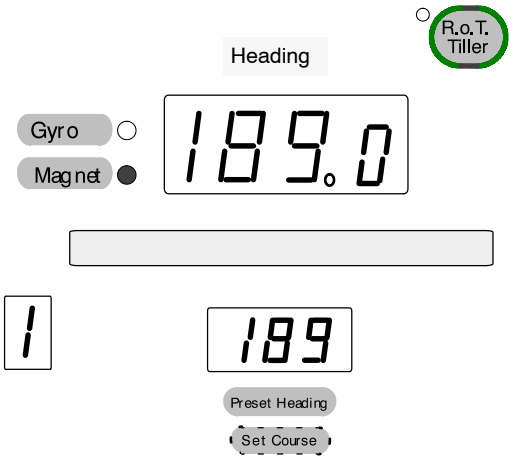
The desired rate of turn depends

- on the initial turning behaviour of the ship
- and on the adjusted parameters.

When the ship starts turning, the rate of turn may be increased up to approx. 50%!

Caution!
Turning behaviour with preset rudder limitation:
If the adjusted rate of turn is not reached due to rudder limitation, the rudder limitation is to be extended only step by step. (steps of < 5°).
Otherwise, the rate of turn might considerably be exceeded because of the integral component of the controller.

	Indications	Comment/Notes
1 Selecting the R.o.T. tiller		
R.o.T. Tiller	Heading Gyro Magnet 184.0 1 184 Preset Heading Set Course	The limit-value adjustment (radius or R.o.T.) is now no longer active. The other parameter settings remain valid in the scope of rate-of-turn control. Possible alarms see Section 2.14.

	Indications	Comments/Notes
2 Re-adjusting the R.o.T. tiller		
		The tiller adjustment (e.g. Port 10°/min) becomes immediately effective. The ship turns with a rate of 10°/min . The operating mode can be varied at any time by actuating a command key.

NOTE: In this mode the rotary knob (Preset heading) is switched off.

2.8 Secondary Operator Units

Within an NP2015/2025 system, several operator units may be managed. If there is no active disturbance (alarm that is not acknowledged), change-over between the operator units can be performed.

Change-over is made directly via the command keys of the operator unit concerned:

- In case of same operating mode, the preset heading preselection is maintained
- If the operating mode is changed, the preset heading is equated with the heading.

Passive operator units are switched to operating mode STANDBY.

STANDBY means;

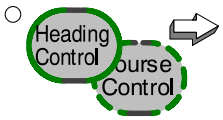
- Indication of preset heading and heading
- Status indication of the heading sensor
- Indication of parameter group
- No possibility of adjustment via function keys
- Operator unit can be selected via command keys

Any active operator unit permits unrestricted system operation and parameter management.

NOTE

If the autopilot is connected via the steering mode selector or via an external steering station, the main steering station is always switched to the operating mode of **Heading Control**.

- Command keys



switches the operator unit to the operating mode of **heading control**, see Section 2.5.

switches the operator unit to the operating mode of **track control**, see Section 2.6.

switches the operator unit to the operating mode of **R.o.T. tiller**, see Section 2.7.

2.9 Operating Mode of Heading Control with a preceding Preset Heading Transmitter, REMOTE Operation

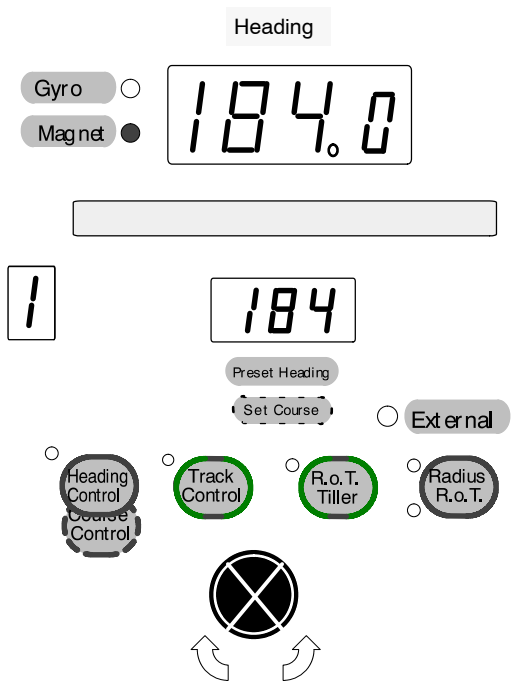
This operation mode requires a navigation system for preset heading preselection (see Handbook of the Navigation System).
The R.o.T. or the radius can also be transmitted from the navigation system to the NP2015/2025.

ATTENTION

In case of REMOTE-operation together with an approved Track control system.

The values for R.o.T. or radius which are preset on the NP2015/2025 are overwritten by the external values. After switching back (e.g. Heading Control), check whether the external, still-valid values for R.o.T. or radius provide for a safe heading- or track change!

Change-over to REMOTE operation is performed via an external switch (see service manual, Connection diagram, Input connection, terminal board L2.47 and L2.48).

	Indications	Comment/Notes
1 Switching on REMOTE operation		
REMOTE-switch OFF **ON**		The autopilot is now controlled via an external steering station. The preset heading preselection is performed in the scope of the parameter settings. Indication on the NP2015/2025: - Preset course and heading - Heading sensor - Alarms (without audible signal) - Current parameter group - Preset info in the text line is maintained Restricted operation: - Command keys blocked - Set radius- or R.o.T. values are not taken into account - Rotary knob functions blocked - Parameter management remains possible - Function of multifunction keys (Section 2.12) is maintained.

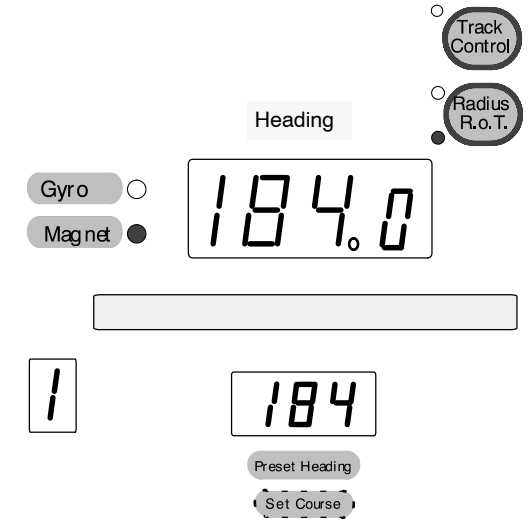
2.10 Preadjustment for the Heading or Track Change Manoeuvre

Preadjustment takes place via a double-function key:

- **R**ate **o**f **T**urn determines the maximum rate of turn (°/min), by which a heading or track change manoeuvre is performed. Entry of parameter value see Section 2.13.3 **Limit Values**.
- **Radius** determines the turning circle radius by which a heading or track change manoeuvre is performed. Entry of parameter value see Section 2.13.3.7 **Limit Values**.

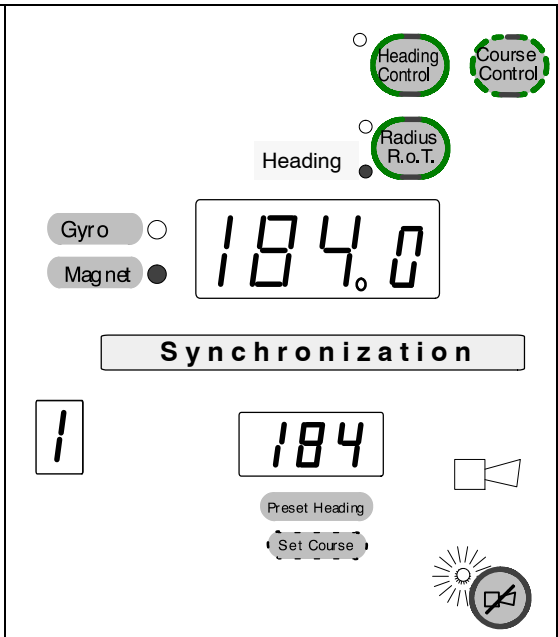
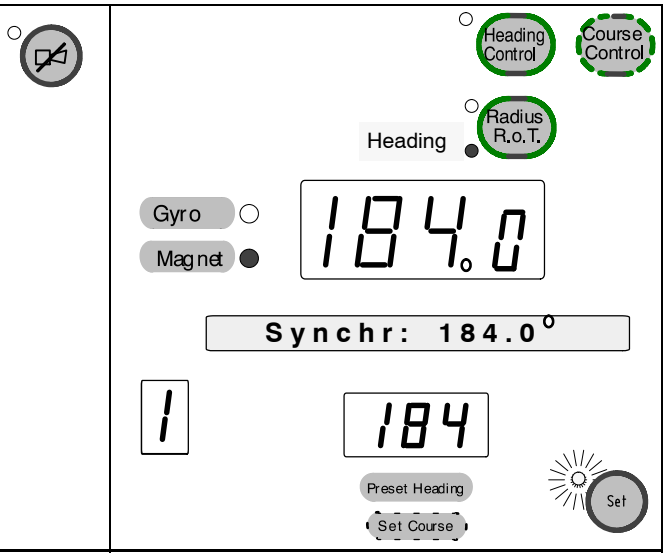
Note

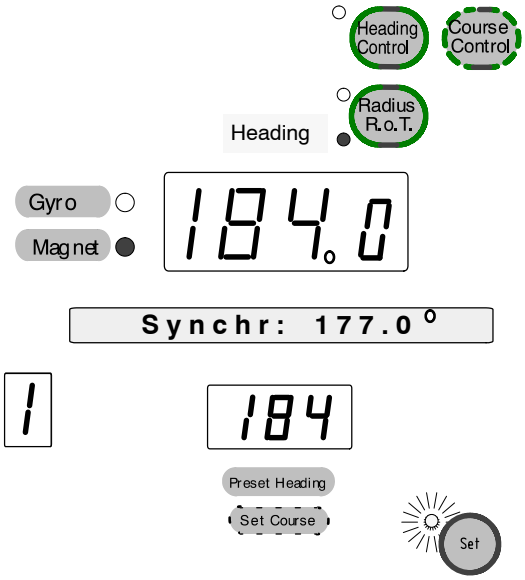
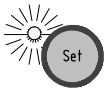
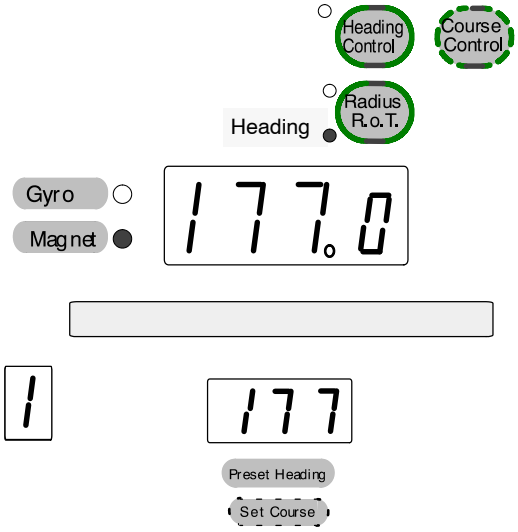
During a heading or track change manoeuvre, do not change the R.o.T radius preadjustment!

	Indications	Comment/Notes
1 Selecting the preadjustment, e.g. from R.o.T. to Radius		
Radius R.o.T.		The next heading change is executed via a preset turning circle radius.

2.11 Synchronization of the Gyro Compass Course with Fine Shaft Transmission

In case of a system start or disturbance (e.g. compass defective or voltage failure), the NP2015/2025 checks the type of compass transmission.
If exclusively fine shaft transmission is recognized, the dialogue is as follows.

	Indication	Comment/Notes
1	Automatic request for synchronization (manual request see Section 2.13.2.5)	
		The last heading is indicated and executed (heading equal to preset heading). Audible signal is heard continuously. The flashing LED signalizes an alarm message (see Section 2.14) and requests acknowledgement.
2	Synchronizing NP2015/2025	
		The last heading is offered as new synchronization value. The flashing LED indicates the data take-over to be acknowledged.

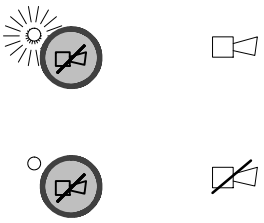
	Indications	Comment/Notes
3 Adjusting a new compass value		
		By actuation of the keys, the current compass course can be adjusted (e.g. 177°). The flashing LED indicates the data take-over to be acknowledged.
4 Acknowledging the new compass value		
		The heading and preset heading indication each are updated by the heading difference.

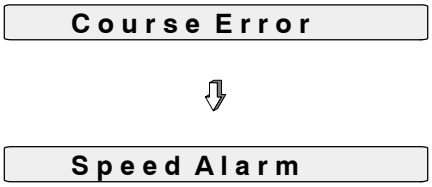
Prior to any departure, check coincidence of heading and compass reading!

2.12 General Function Keys

2.12.1 Acknowledgement or Alarm Screening Key at the NP2015/2025

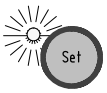
-

	Indications	Comment/Notes
Key function in case of active disturbance		
		The LED is flashing, audible signalling is heard. On pressing the key, the audible signalling is deactivated. The alarm message is stored. The flashing LED is changed over to continuous light.

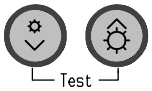
	Indications	Comment/Notes
Screening the stored alarm messages		
		The luminous LED serves as a note for alarms still active. By actuation of the key, these will be indicated one after another. Alarms that are no longer active are automatically erased from the storage.

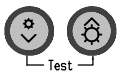
2.12.2 Key to Acknowledge Various Inputs

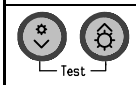
-

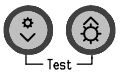
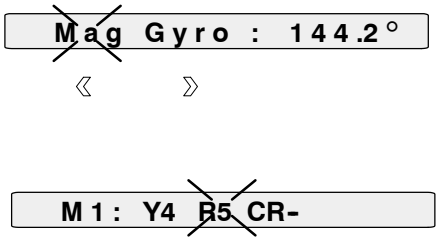
	Indications	Comment/Notes
Acknowledging an action		
		The LED of the key flashes for each action to be acknowledged. Acknowledging means: Value or setting to be accepted or to be executed.

2.12.3 Keys for Dimming and Setting Values

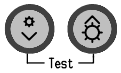
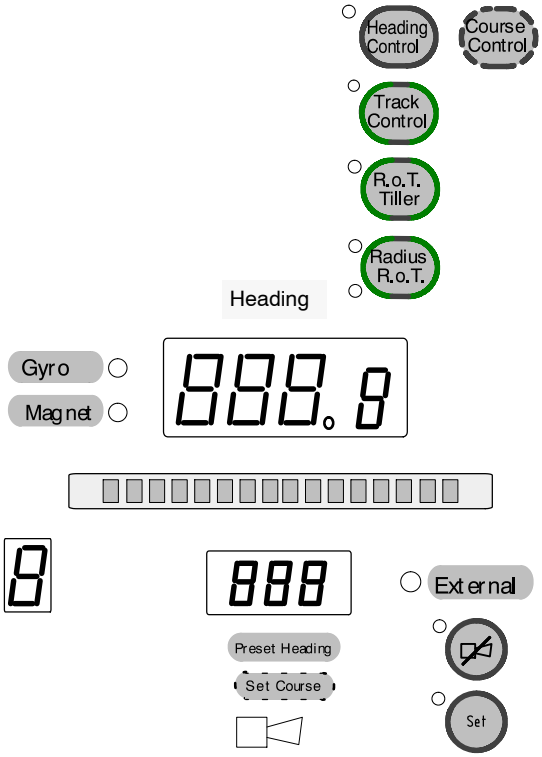
- 

	Indications	Comment/Notes
Dimming the indications or key illumination		
		Actuating a key results in that the luminosity is varied.

	Indications	Comment/Notes
Adjusting the new value of a selected parameter		
	**M a n : + 1 7 . 2 kts s e l**	Coarse value adjustment is performed by pressing a key continuously. Fine adjustment is made by touching the key momentarily.

	Indications	Comment/Notes
Adjusting a new heading sensor or parameter value		
		Preadjustment see Section 2.13.2 **Sensor**. The flashing lettering within a text line indicates the selected sensor. Actuation of a key results in that the heading sensor is changed. Preadjustment see Section 2.12.3.1 **Control Preset**. By actuating a key, a new value adjusts itself. (For acknowledgement, actuate **SET** key)

2.12.3.1 Display test

	Indications	Comment/Notes
Starting the lamp test- only possible in the operating mode NP2015/2025 PASSIVE		
		By actuating the keys simultaneously, the lamp test adjusts itself. Subject to test: - All displays (7-segment display) - Status indications - Status indications of keys - All indicating elements of the text line (16 pcs) - Audible signalling The test lasts for approx. 10s, subsequently, the last valid indicator surface appears. ⚠ In case a visual error is recognized, the R.A. Service **must** be informed for REASONS OF SAFETY!

2.12.4 Rotary Knob

Range of adjustment:
The resolution of the turning knob can be switched over from a step width of 1° to 0.1° and indicated via the display key (see chapter 2.13.4).

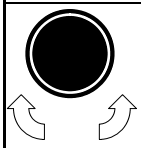
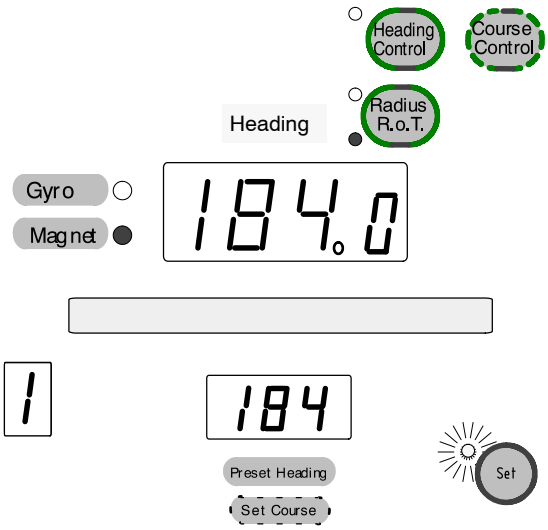
The rotary knob can be used during the operation mode **Heading Control** and partially used in the operating mode **Track Control** (only when using an **XTE** NMEA telegr.)

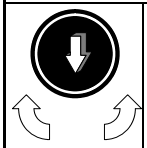
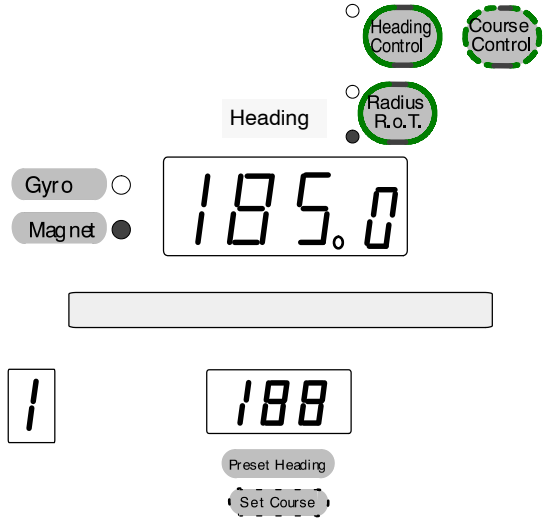
Rotary knob not pressed:
This passive knob adjustment is recommended for a prepared heading change.
The heading change will be executed after acknowledgement only (**SET** key).

Rotary knob pressed:
This active knob adjustment is recommended for a special manoeuvre.
Depending on the configuration setting (see Annex 1-3), the following automatism results:

⇒ Configuration setting **Maneuver No** has been selected
pressing and re-adjusting the rotary knob results in an immediate heading change within the range of the preselected R.o.T. limitation.

⇒ Configuration setting **Maneuver Yes** has been selected
pressing and re-adjusting the rotary knob triggers an immediate heading change with an R.o.T. limitation of 120°/min (standard value).
This standard value is only executed when the preselected R.o.T. value is < 120°/min. In case of an R.o.T. value >120°/min, the presetting remains valid (unchanged).

	Indications	Comment/Notes
Re-adjusting the rotary knob (passive)		
		See Section 2.5 **Heading Control**. The preset heading preselection is only accepted and carried out when the key is pressed.

	Indications	Comment/Notes
Pressing the rotary knob and readjusting it (active)		
		See Section 2.5 **Heading Control**. Observe the selected configuration.

2.13 Function Keys

2.13.1 Parameter Management

Within the parameter management, the following services are available:

- Direct selection of the parameter of Yawing, Rudder,Cnt. Rudder
- Preparing parameter groups with individual Yawing, Rudder, Cnt. Rudder values

- **Economy**/**Precision** Mode of Operation (only NP2025)
  The NP2025 reacts automatically to current weather conditions when in this operating mode.
  The following key functions are modified as follows in this operating mode:
  - The *Parameter* key is used to modify the Yawing, Rudder, and Cnt. Rudder parameter values.
  - The *Control Preset* key allows you to select **Economy** or **Precision**

- **Quick-Tune** Mode of Operation

When in this mode of operation, up to 6 numerically administered parameter groups can be created; these groups effect the precision of the Autopilot, depending on the circumstances at the time.
When a parameter group is called up and acknowledged, an image of the required parameter group is loaded into memory.
The parameter values of the loaded group can be individually altered in memory depending on the situation. This altered set of parameters is, however, not permanently loaded into the parameter memory.
The following key functions are modified as follows in this operating mode:

- The *Parameter* key is used to open and modify a temporary parameter group. Furthermore, this key function is used for the valency of the parameter group.
- The *Control Preset* key allows the selection of a parameter group (...6) (Quick-Tune).

- Sensor keys
  - selection of the heading sensors
  - synchronization of the autopilot with the gyro compass (when no absolute heading information is available)
  - switching between manual speed or log sensor

- Limits/Values
  setting the limit values or the alarm threshold.

- Display keys
  selection a permanent display in the text line.

2.13.1.1 Operating mode Economy/Precision -Parameter- (only for NP2025)

Parameter values Yawing, Rudder, Cnt.Rudder can be pre-set for both modes of operation (Economy **E** or Precision **P**).

	Indications	Comment/Notes
1 Calling up parameter (actual operating mode Economy **E**)		
Para-meter	**Yawing: 2** ⇩ **Rudder: 5** ⇩ **Cnt.Rudder: 5** E Set	On actuating the key, e.g. this parameter appears. The represented parameter values are preset at the works (default values). Parameter 2 is still occupied The flashing LED of the key requests acknowledgement.
2 Varying one or more parameter value		
⇩ ⇧	**Yawing: 3** E Set	On actuating one of the keys, a new value appears. The flashing LED of the key requests acknowledgement. If desired, the next parameter, as shown in Point 1, can be called up and varied.
3 Accepting the parameter value		
Set	**Yawing: 3**	The new value is accepted.

2.13.1.2 Operating mode Economy/Precision -Control Preset- (only for NP2025)

In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

1 Display Mode of Operation		
Control Preset	Econ ~~Precision~~ P	Both modes of operation are displayed on the text line. The display shows the active mode of operation.
2 Switching Modes of Operation		
	~~Econ~~ Precision E Set	You can switch over the mode of operation on the text line by pressing a key. The flashing LED on the key requests you to acknowledge the setting.
3 Confirming the New Mode of Operation		
Set	~~Econ~~ Precision E	The mode of operation is activated.

2.13.1.3 Operating mode Basic -Parameter-

Possible situation on the device:

– No parameter groups have been adjusted (display for the allocation ot the parmeter groups is dark).

In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Calling up parameter		
Para-meter	Yawing: 2 ⇩ Rudder: 5 ⇩ Cnt. Rudder: 5 Set	On actuating the key, e.g. this parameter appears. The represented parameter values are preset at the works (default values). Parameter 2 is still occupied The flashing LED of the key requests acknowledgement.
2 Varying one or more parameter values		
	Yawing: 3 Set	On actuating one of the keys, a new value appears. The flashing LED of the key requests acknowledgement. If desired, the next parameter, as shown in Point 1, can be called up and varied.
3 Taking over parameter value		
Set	Yawing: 3	The new value is taken over.

2.13.1.4 Operating mode Control –Preset – QUICK TUNE

Via this key, the parameter groups are managed and continuously indicated.

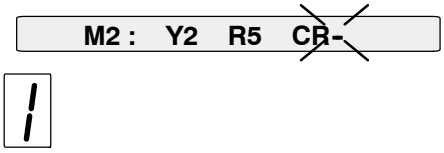
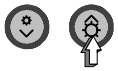
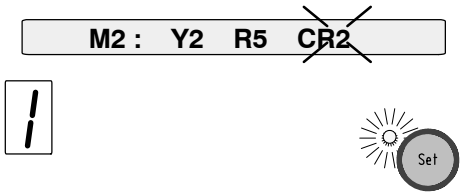
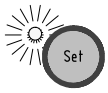
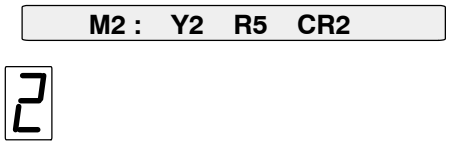
In case of lengthy input pauses (approx. 15s), a time–out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Screening the parameter group		
Control Preset	M1 : ~~Y4~~ R5 CR6 1	By actuating the key, e.g. this set of parameters is adjusted. The corresponding parameter group number is indicated.
	M2 : ~~Y-~~ R- CR-	Parameter group 2 is still not allocated.
	Set	The flashing LED of the key requests acknowledgement.
2 Calling up parameter group 1		
Control Preset	M1 : ~~Y4~~ R5 CR6 1	Actuate the key until the group appears in the text line.
	Set	The flashing LED of the key requests acknowledgement.
3 Loading parameter group 1 for operation		
Set	1	NP2015/2025 executes heading control with parameter group 1.

2.13.1.5 Defining a Parameter Group (e.g. parameter group 2)

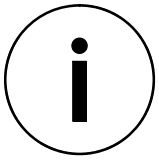
In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Defining parameter group 2		
Control Preset	M2 : Y- R- CR- 1 Set	By actuating the key, parameter group 2 is adjusted. The flashing LED requests acknowledgement.
2 Calling up first parameter value		
Para-meter	M2 : ~~Y-~~ R- CR- 1	
3 Adjusting parameter value for Yawing		
	M2 : ~~Y2~~ R- CR- 1	Adjust permissible value (1 to 6), e.g. 2.
4 Calling up second parameter value		
Para-meter	M2 : Y2 ~~R-~~ CR- 1	
5 Adjusting parameter value for Rudder		
	M2 : Y2 ~~R5~~ CR- 1	Adjust permissible value (1 to 9), e.g. 5.

	Indications	Comment/Notes
6 Calling up next parameter value		
		
7 Adjusting parameter value for Cnt. Rudder		
		Adjust permissible value (0 to 9), e.g. 2. The flashing LED requests acknowledgement.
8 Storing parameter values of group 2		
		By actuating the key, parameter group 2 is stored.

2.13.2 Sensor

By this key function, the connected sensors for heading and speed can be managed.



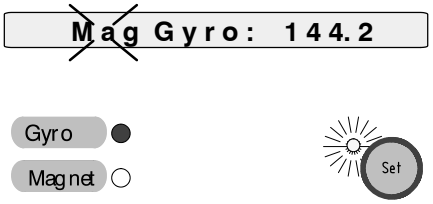
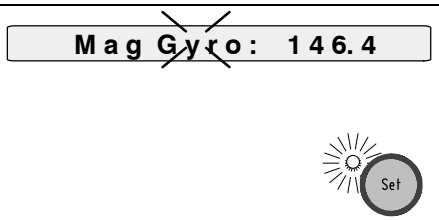
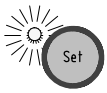
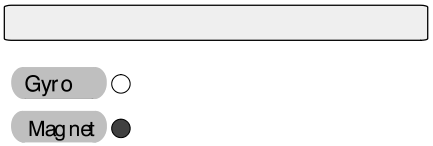
In case of lengthy input pauses (approx. 15s), a time -out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Screening sensors		
Sensor	Mag Gyro: 144.2	By repeated key depression, the next text line appears.
	Man: + 17.2 kts sel	
	Log: + 12.7 kts	This text line is shown only when a log sensor is available.
	Synchr: 234.6	This text line will be indicated with fine shaft transmission only (see Section 2.11).
	Set	The flashing LED requests acknowledgement.

Flashing indication >< (text/value) in the display shows the actual setting.
Selected type of speed is marked with an **sel**.

2.13.2.1 Selection of Heading Sensor (Gyro(Magnet)

In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Calling up course sensor		
		The lettering of heading sensor still active (**Mag**) is flashing. The flashing LED requests acknowledgement.
2 Changing the heading sensor		
		The lettering for gyro compass (**Gyro**) is flashing. The flashing LED of the key requests acknowledgement.
3 Acknowledging heading sensor		
		On actuating the key, the heading sensor selection is acknowledged. The text indication disappears.

Operating mode of **HEADING CONTROL**
If the magnetic compass values and gyro compass values are different, switching-over to the compass difference results in a preset heading adaptation.
Possible heading differences between preset heading and heading remain in existence.

Operating mode of **TRACK CONTROL**
In this connection, the preset heading indication may deviate from the indication on the navigation receiver due to the changed heading sensor selection!

2.13.2.2 Manual Ship's Speed

The manually entered ship's speed must correspond to the current speed.

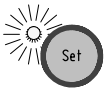
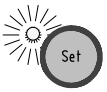
In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Calling up parameter		
Sensor	Man: 17.2 kts sel Set	By actuating the key, the last actual value appears. The flashing LED of the key requests acknowledgement.
2 Adjusting or updating the ship's speed		
	Man: 13.2 kts sel Set	By actuating the key, the desired value can be adjusted. The flashing LED of the key requests acknowledgement.
3 Acknowledging the value		
Set		By actuating the key, the value is accepted. The text indication disappears.

Caution: Don't use the radius control in combination with manual ship's speed (only with speed-log information.

2.13.2.3 Switching over from maual ship‘s speed to automatical ship‘s speed

In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
Sensor	**Man: 17.2 kts sel** 	Actuate the key “Sensor” until “**Man:**” is displayed. The set speed value flashes. The supplement “**sel**” means, that operating mode “**Manual**” is selected.
Switch to automatic ship‘s speed		
Sensor	**Log: 12.7 kts sel** 	Actuate the key “Sensor” until “**Log:**” is displayed. While the LED at the key “**Set**” is flashing, this key has to be operated. A succesfully switch over is indicated by the supplement “**sel**” at the display.
To switch over from automatic ship‘s speed into manual ship‘s speed has to be performed in corresponding reverse order		

2.13.2.4 Indication of Current Ship's Speed (only in connection with a log sensor) – switched over to Log Sensor–

In case of lengthy input pauses (approx. 15s), a time–out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Calling up parameter		
Sensor	Log: 12.7 kts sel Set	By actuation of the key, the current value appears. The flashing LED of the key requests acknowledgement.
2 Taking over log value for autopilot control		
Set		The text indication disappears.

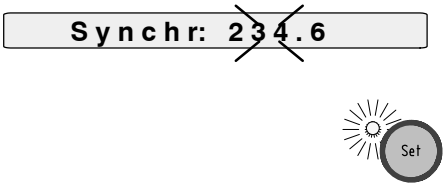
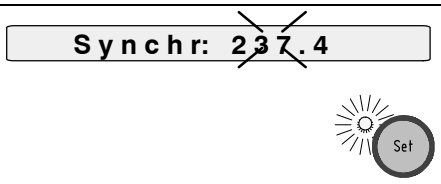
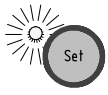
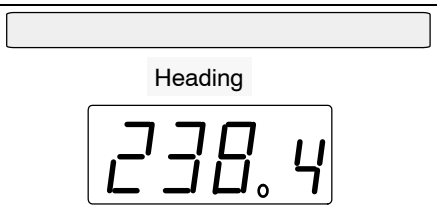
Switching over from **Man** speed to **Automatic** speed (Log), see section 2.13.2.3

2.13.2.5 Synchronization of Gyro Compass Course

The synchronization is only required with exclusive fine shaft transmission.

Due to, e.g. a power breakdown, synchronization trouble can occur during transmission of the gyro compass course to the autopilot. The NP2015/2025 senses this condition during a system start (the **Synchronization** alarm is triggered).

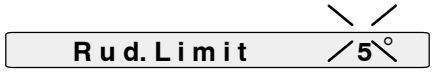
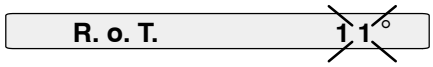
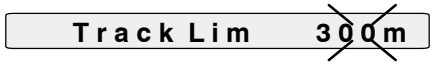
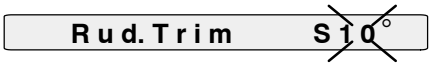
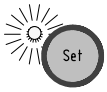
In case of lengthy input pauses (approx.15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1)

	Indications	Comment/Notes
1 Calling up parameter (possible with exclusive fine shaft transmission only)		
		By actuating the key, the current value appears. The flashing LED of the key requests acknowledgement.
2 Varying the synchronization value		
		On actuating a key, the current value can be adjusted. The flashing LED requests acknowledgement.
3 Acknowledging the synchronization value		
		The text indication disappears. Heading corresponds to that of the gyro compass display.

2.13.3 Limit Values

Within this key function, parameters with different limit values and the values for ship's load (only NP2025) can be called up adjusted.

In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again (see Section 2.12.1).

	Indications	Comment/Notes
1 Screening parameter		
		Determines the maximum rudder position in ° which the steering gear will not exceed during autopilot journeys.
		Determines the monitoring boundaries (port/starboard) during the operating mode heading control. (see section 2.5).
	or	
		Determines the drift correction during the track control.
		Gives the maximum R.o.T. for change of heading to be carried out by the NP2015/2025 (see section 2.10).
		Determines the radius for change of heading to be carried out by the NP2015/2025 (see section 2.10).
		Determines the monitoring boundaries (port/starboard) during the operating mode track control (see section 2.6.3).
		Determines the rudder bias*: For normal journey/maneuver the value should be set to 0° (automatic rudder bias is active). For special maneuvers (e.g. towing), manual rudder bias can be set (automatic rudder bias is switched off).
	or	
	(this parameter was deactivated, see service manual annex configuration mode)	
		Only NP2025 Determines the load condition for the optimization of the heading control regulation in dependence on the load of the ship . The load condition is entered in % .
		The flashing LED of the key requests acknowledgement.

*** Rudder bias**

A bias rudder angle is a rudder bias which, via integral parts of the heading control, automatically sets in as a result of disturbances on the ship.
The aim, despite a disturbance, is to keep the ship on the preset heading.

Constant disturbances can be produced, by wind, rough sea or asymmetrical pressure, e.g. whilst towing.

Particularly for the disturbances wind and rough sea, the constant rudder can only be correct for a particular heading range. For this reason, the integral proportion (constant rudder) of the heading regulator is deleted when there is a change in preset heading of >20°.

As well as an automatic rudder bias, a manual bias can also be installed. This can be achieved through a change in the value of the parameter **Rud.Trim**.

For normal drive/maneuver the parameter **Rud.Trim** must be set at **0**.

- **Rud.Trim 0** means:
  The rudder bias will automatically be determined from the autopilot.

- **Rud.Trim** for example **3** means (the automatic rudder bias is not active):
  during for example towing the approximate heading will be determined.
  Through changing the value of the **Rud.Trim** a stable heading can be achieved.
  The optimal parameter value is revieled by observing the heading direction.

2.13.3.1 Information on Heading Monitoring OFF Heading

The function heading monitoring is active during operating mode *Heading Control.*

The heading monitoring has two essential functions:

- Monitoring of Off Heading during course-keeping operation
- Monitoring of track change phase via a time window

Monitoring of heading differences during course-keeping operation
The function Course Alarm Monitoring monitors deviations from the preselected desired course of the ship. The monitoring threshold is set via the control unit (see section 2.13.3.3) and allows settings in a range of 5 to 30 degrees.

If the ship leaves the desired course and thereby exceeds the preselected monitoring threshold, an optical and acoustical alarm is triggered. The autopilot is provided with a potential-free alarm contact which, for example, enables the control of an additional alarm unit.

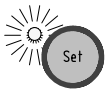
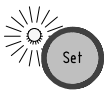
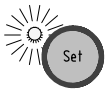
Monitoring the track change phase via a time window
The alarm is suppressed during the off heading phase.The time window is calculated from the difference in the desired course and the pre-selected turning rate.
If during the track change manoeuvre the ship enters the heading alarm threshold within the time window**,** no alarm is triggered.

Note
The desired value for the rate of turn (R.o.T. see section 2.13.3.5) depends on the ship.The ship must be able to perform the turning value.Desired rate of turns exceeding the turning capability of the ship results in triggering the heading alarm prematurely.
If the ship leaves the desired course and thereby exceeds the preselected monitoringThis effect can also occur if the rudder limit is adjusted (rudder limit see section 2.13.3.2) too closely when more rudder deflection is needed.

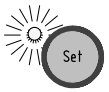
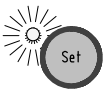
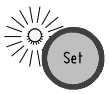
On taking the autopilot into operation make sure that the basic setting of the course controller is precisely adjusted (trials). For the control of the turning rate a sufficient rudder amplification (optimize rudder parameters) must be ensured.

If the desired course, the radius, or the turning rate are changed during the track change manoeuvre, the time window will be immediately calculated new.

2.13.3.2 Rudder Position *Rud.Limt* Installing

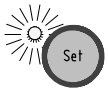
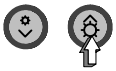
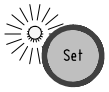
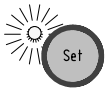
	Indications	Comment/Notes
1	Parameter Rud.Limit request	
Limits Values	Rud. Limit 5° 	The flashing LED requests acknowlegdement
2	Adjusting the new parameter value for example 30°	
	Rud. Limit 30° 	By activating the key, the current value is set. The flashing LED requests acknowlegdement.
3	Acknowlegding and saving the new parameter value	
		The text line will be over-written.

2.13.3.3 Limit Value for *Off Heading* Changes

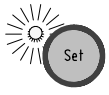
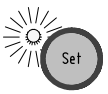
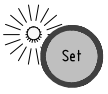
	Indications	Comment/Notes
1	Parameter Off Heading request	
Limits Values	Off Heading 6° 	The flashing LED requests acknowledgement.
2	Adjusting the new parameter value for example 8°	
	Off Heading 8° 	By activating the key, the current value is set. the flashing LED requests acknowledgement.
3	Acknowledging and saving the new parameter value	
		The text line will be over written.

2.13.3.4 Limit Value for *Course Trim* changes

Operating mode *Track Control*

	Anzeigen	Bemerkung/Hinweise
1 Parameter Course Trim request		
Limits Values	Course Trim 15° 	The flashing LED request acknowledgement.
2 Adjusting the new parameter value for example 20°		
	Course Trim 20° 	By activating the key , the current value is set. The flashing LED requests acknowledgement.
3 Acknowledging and saving the new parameter value		
		The text line will be over written.

2.13.3.5 Rotary rate *R.o.T.* Change

	Indications	Comment/Note
1 Parameter R.o.T. request		
Limits Values	R. o. T. 11° 	The flashing LED requests acknowledgement.
2 Adjusting the new parameter value for example e.g. 20°		
	R. o. T. 20° 	By activating the key, the current value is set. The flashing LED requests acknoweldgement.
3 Adjusting and saving the new Parameter value		
		The text line will be over written.

2.13.3.6 Adjusting a new ships loading condition in % (NP2025 only)

	Indication	Comment/Note
1 Parameter Ship load request		
Limits Values	**Ship load 40%** Set	The flashing LED requests acknowledgement.
2 Adjusting a new ships loading e.g 60%		
	Ship load 60% Set	By activating the key, the current value is set. The flashing LED requests acknoweldgement.
3 Adjusting and saving the new Parameter value		
Set		The text line wil be over written.

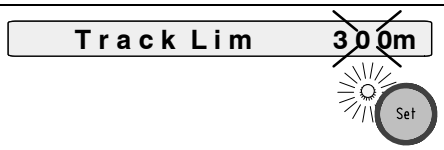
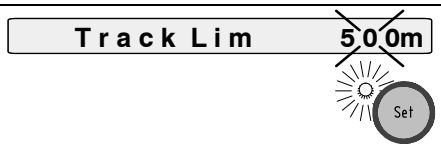
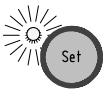
2.13.3.7 Changing the *Radius*

Caution: Radius controll is only permitted under Speed-Log-Information, to achieve the necessary accuracy of the radius.

	Indications	Comment/Notes
1 Parameter radius request		
Limits Values	**Radius 2 NM** Set	The flashing LED requests acknowledgement.
2 Adjusting the new parameter value for example 4NM		
	Radius 4 NM Set	By activitating the key, the current value is set. The flashing LED requests acknowledgement
3 Acknowledging and saving the new parameter value		
Set		The text lines will be over written.

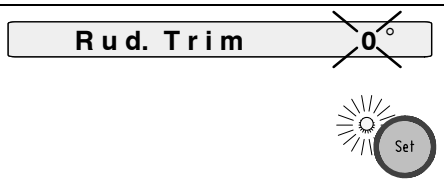
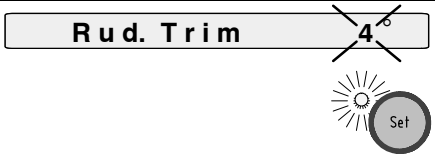
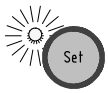
2.13.3.8 Monitoring Limit (Port/Starboard) *Track Lim* Changes

Operating mode Track control

	Indications	**Comment/Notes**
1 Parameter Track Lim request		
		The flashing LED requests acknowledgement.
2 Adjusting the new parameter value for example 500 m		
		By activating the key, the current value is set The flashing LED key requests acknowledgement
3 Adjusting and saving the new parameter value		
		The text lines will be over written.

2.13.3.9 Rudder Bias *Rud.Trim* Installation (Manual Rudder Bias)

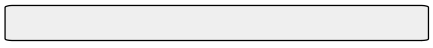
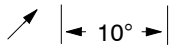
The parameter has to be activate by the configuration mode (see service manual).

	Indications	**Comment/Notes**
1 Parameter Rud.Trim request		
		The flashing LED requests acknowledgement
2 Adjusting the new parameter value for example 4°		
		By activating the key, the current value is set The flashing LED requests acknowledgement
3 Adjusting and saving the new parameter value		
		The text lines will be over written

2.13.4 Display

Calling-up of a display information is made via the DISPLAY key. With any key depression, a new function is adjusted.

Alarm or warning messages are treated as of highest priority and are indicated immediately. On acknowledging the alarm message, the last display information appears again. Calling-up or editing of parameters remains possible. The text line concerned disappears due to acknowledgement. The last display information is displayed again.

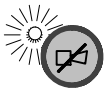
	Indications	Comment/Notes
Possible information display		
		Indicates a neutral text line.
	⇩ (Bar-Limit 10°)	
		Shows the heading deviation (only with the operating mode of heading control) as a tendency indication. The tendency indication can be adjusted via the configuration of **Bar-Limit** (see Service manual Annex 1-2).
	 (Pointer for limit exceeding)	
	⇩	
	Man: + 17.2kts	
	or	
	Log: 12.7kts	Indicates the current speed, manual or transmitted via log sensor.
	⇩	
	Preset HDG: 098.4	Indicates the current preset heading with a 1/10 degree of resolution.
	⇩	
	XTD: | 0.29NM	Indicates the track deviation on the left or on the right of track. This information indication can be called up during the operating mode of **TRACK** only.
	⇩ (e.g. 0.29NM right of the track)	
	Set rudder: P 10°	Indicates the current set rudder position, **P** for Port, **S** for Starboard.

2.14 System Messages

As a matter of principle, system messages are indicated via the text line as plain text information. Dependent on the significance of the messages, a text in the text line is overwritten by the system message. The plain text info is represented by an audible signal and by the flashing LED of the symbol key.
System messages can be subdivided into 3 categories:

⇒ **Alarms**, the audible signalling releases a continuous sound, the LED of the is flashing. Within the text line, a plain text information in acc. with the alarm appears.
On the operator unit, no inputs can be made. After the alarm has been acknowledged, the signalling is deactivated (see Section 2.12.1).
The operator unit can now be used again.
The error message is written into a memory until elimination of the disturbance.
The LED of the key is lit permanently
By actuating the key once more, all error messages stored in the memory can be indicated one after another.

⇒ **Warnings**, every 90s, a sound is heard three times from the audible signalling, the LED of the key is flashing. The text info appears in the text line for approx. 15s.

⇒ **Note**, every 90s, a sound is heard three times from the audible signalling, the LED of the  key is flashing. The text info appears in the line for approx. 15s.

2.14.1 Alarms

No.	Indication	Signification	Possible Cause	Effects on Operation	Action/Measures
1	CHECK VALUES	Initial start	During the system's starting phase, a memory test is executed. If an implausibility is recognized, all parameter values are automatically replaced by default values.	All individually adjusted values get lost. The ship specfic parameter value (**MODE**: Panel ***Para***) will be servive.	With the system start completed, the individual parameter profile can now be adjusted (see Section 2.13).
2	Off heading	Heading error. A preset heading / heading monitoring, referred to an adjusted heading error alarm threshold, is performed. **Off Heading in track change phase** basic setting of autopilot is faulty	Compass disturbance. Sudden drift effects. Selected turning rate value is too high. Rudder limiting function sets in. R.o.T conroller not adjusted in the best possible way.	In accurate heading keeping. Ship cannot follow turning rate. Extend rudder limit. Optimize rudder parameters.	Eliminate compass disturbance. Check heading error alarm threshold, adapt, if required (see Section 2.13.3). Check rudder controls. See section 2.13.3.7 Radius. See section 2.13.3.2 Rud. Limit See section 2.13.3.3 Parameter
3	Gyro-Ref:ERR*	Gyro compass failure	External disturbance.	No heading or track control with gyro compass possible.	Change over to MAG compass (see Section 2.13.2.1).
4	TMC-Ref:ERR	Magnetic compass failure.	External disturbance.	No heading or track control with magnetic compass possible.	Change over to GYRO compass (see Section 2.13.2.1).
5	Speed Alarm	Data from speed sensor is not plausible.	External disturbance.	The autopilot may show a different control behaviour.	Change over to manual speed adjustment (see Section 2.13.2.2).
6	Log missing	Speed sensor failure.	External disturbance.	The autopilot may show a different control behaviour.	Change over to manual speed adjustment (see Section 2.13.2.2).
7	Track ext. Error	Disturbance of external set course transmitter (REMOTE function).	External disturbance.	No externally controlled track control possible.	Change over to HAND control (see Section 2.3).
8	Navdata missing	Cyclic data transmission between navigation system and autopilot interrupted.	External disturbance. Interface disturbed - not connected	No track control possible.	Change over to heading control (see Section 2.5).
9	Navdata fail	Data transmission between navigation system and autopilot interrupted.	External disturbance. Interface disturbed - not connected	No track control possible.	Change over to heading control (see Section 2.5).

No.	Indication	Signification	Possible Cause	Effects on Operation	Action/Measures
10	Dist. > Tr. Limit	X-track range has been left.	Strong drift effects.	Ship's position is off the track.	Bring ship back to the track by changing over to heading control (see Section 2.5). Extend X-track range, if required (see Section 2.13.3).
11	Course > 60°	The angle from heading to planned track course > 60°.	Not allowed condition to activate track control.	Operating mode of track control cannot be selected.	The course is to be corrected correspondingly via the operating mode of heading control (see Section 2.5) or by changing over to HAND control.
12	Synchronization	Synchronization alarm.	Coarse shaft of gyro compass failed or not existing. Power on or restart happened.	No heading or track control is possible.	Perform synchronization (see Section 2.11).
13	Heading fault	Course bus faulty.	External disturbance.	Heading or track control not possible. No heading reading	Change over to HAND control (see Section 2.3). Repairs, see section 2.4.
14	I/O-PCB Err.	I/O PCB operating faultily.	I/O PCB is defective.	Autopilot NP2015/2025 not ready for operation.	Change over to HAND control (see Section 2.3). Repairs, see section 2.4.
15	No Telegrams	Telegram transmission between operator unit and electronic connection box disturbed.	Internal disturbance. Computer disturbance.	Autopilot NP2015/2025 not ready for operation.	Change over to HAND control (see Section 2.3). Repairs, see section 2.4.
16	No Connection	Telegram transmission between operator unit and electronic connection box interrupted.	Internal disturbance. Computer disturbance.	Autopilot NP2015/2025 not ready for operation.	Change over to HAND control (see Section 2.3). Repairs see section 2.4 .
17	Track interrupt	During the track control the ECDIS operating faultily.	Positionreceiver failure.	Autopilot NP2015/2025 track control is still going on and set XTD to 0.	ECDIS perhaps change over to Heading Control. 2.2

* Attention: This error alarm is actuated
Signal Unit indicates SYY alarm

2.14.2 Warnings

No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
1	Rudder Limited 3x after 90s	Rudder limit reached.	R.o.T. limit value selection too high, or rudder limitation too low.	The required R.o.T will not be reached	Adapt R.o.T. correspondingly (see Section 2.10)
2	Low-Speed 3x after 90s	Ship's speed too low	Log failure or interruption.	Autopilot NP2015/2025 shows instable behaviour.	Change over to manual speed adjustment (see Section 2.13.2.2).

2.14.3 Notes

Nr.	Indication	Signification	Possible Cause	Effects on Operation	Measures
1	Course Trim	Extension proposal for track control	Strong drift from the track.	Increasing track error.	Execute course Trimextension proposal max. to 30°
2	TRK CRS: ---.- 3x	The navigation receiver offers a new track course proposal.	Prepared track range.	The track course proposal must be acknowledged. Otherwise, the ship gets away from the planned route.	Achnowledge track course proposal and, with this, activate track change. Or, change over to heading control.
3	Override defect.	In the OVERRIDE tiller mode >4s no telegram transmission between tiller and autopilot was disturbed.	Tiller is defective. Bus connection disturbance.	Tiller controlled rudder steering is not possible.	Change over to HAND control or heading control.
4	Heading jumped see service mode selection	Heading display is jumping. Preset Heading display is jumping in the same way.	STD 20 or Magnet compass change over. Manual speed correction on the Heading Reference System.		Accept the alarm.
5	TMC-Ref selected	STD 20 compulsory cange over to Magnetic compass.	STD 20, compass change over. TMC operation.		Accept the alarm. Perhaps change over to heading control.
6	STANDBY	Change-over to a secondary operator unit has been made.			Set steering mode selector to HAND control. Activate secondary operator unit (see section 2.8).

C O N T E N T S Annex

Operation with high speed (HSC)
Operator Unit Annex 1-1
Summary of Configuration Annex 1-2

Quick Manual

AUTOPILOT NP2015/2025

Operator Manual

Economy/ Precision

- **Modification** of the parameter
  Yawing
  Rudder
  Cnt.Rudder

- **Display** indicates the current operating mode
  E for Economy
  P for Precision

- **Change over** to the operating mode **Economy** or **Precision**.

Basic

- **Opens** a temporary parameter group
- **Modification** of the temporary parameter group
- **Preadjustment** for preparing or varying a parameter group (M1..M6)

- **Display** for the numerical assignment of the parameter groups

- **Calling up** a parameter group (M1 ..M6)
  Quick-Tune

- **Indication** of the current heading sensor
- **Indication** of log sensor
- **Indication** of the manual speed adjustment
- **Presetting** for
  - Heading sensor selection
  - Manual speed adjustment
- **Synchronization** between heading sensor and NP2020 (only with fine shaft transmission)

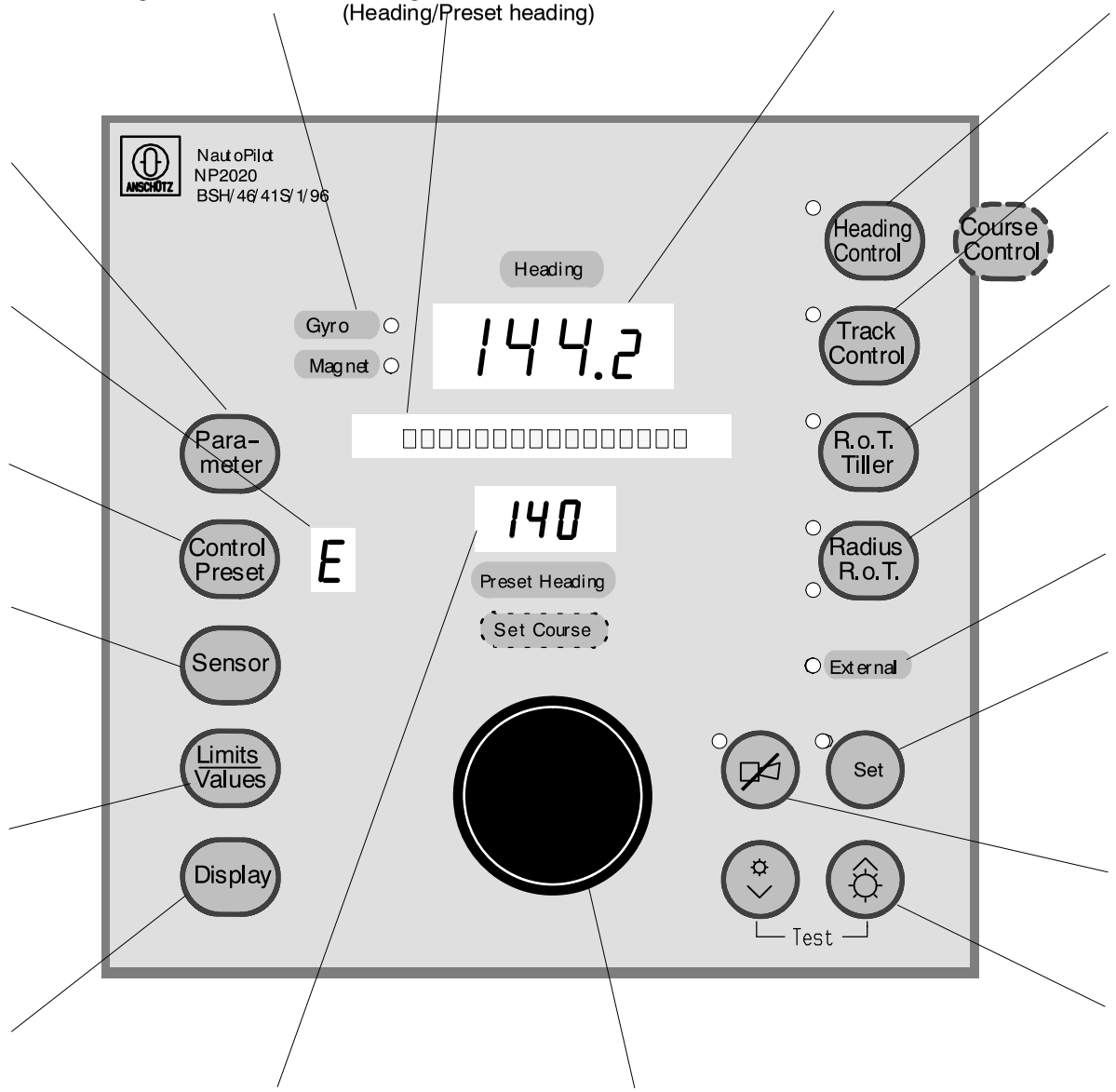
- **Indication** or **presetting** for
  - Rudder Lim ...°
  - Off Heading ...°
  - Course Trim ..°
  - Rot ...°/min
  - Radius ...NM
  - Track Lim ...m
  - Rud. Trim ...°

- **Fading out** the text line (except for not acknowledged alarm messages)
- **Fading in** a continuous text or bar graph representation;
  - Heading difference indication as bar graph representation in the operating mode of *Heading Control*
  - Track error (XTE) in the operating mode of *Track Control*
  - Manually adjusted speed
  - PresetHDG with 1/10° indication
  - Set rudder position in °

- **Status indication**, indicates the adjusted heading sensor

- **Alphanumeric line**, as text line or bar graph representation for the heading difference indication (Heading/Preset heading)

- **Display** for heading indication



- **Display** for preset heading indication shows:
  - in the operating mode *Heading Control* the preset heading
  - in the operating mode *Track Control* the track course
  - in conjunction with an R.o.T. tiller the heading
  - in the passive state of device (OFF) the heading

- **Preset heading presetting in conjunction in with the SET key**
  (only possible in the operating mode *Heading Control*)
- **Direct preset heading presetting**
  (only possible in the operating mode *Heading Control*)
  For this method, the rotary knob is first to be pressed and then readjusted. The preset heading alteration is effective immediately!

- Command key.
  Switches to operating mode *Heading Control* (LED lights up).

- Command key.
  Switches to operating mode *Track Control* (LED lights up).
  Only possible in conjunction with an external track planning system or navigation receiver.

- Command key.
  Switches to operating mode *R.o.T. Control* "Rate-of-Turn" (LED lights up).
  Only possible in conjunction with an external R.o.T. tiller

- **Determines** the type of change of heading.
  - Heading change via a determined radius value (LED lights up), or
  - Heading change via a determined R.o.T. limit value (LED lights up)

- **Status indication**, indicates REMOTE operation.

- The flashing LED signalizes an action which will be stored or effective only when **acknowledged**.

- **Acknowledges** the audible alarm. LED shows red. The alarm message is stored.
- **Screening** the stored alarm messages. All alarm message are cyclically indicated via the text line.

- **Dimmer** for key and display illumination.
- **Modification** of parameter values.
- **Selection** of heading sensor
- **Lamp test** (both keys to be actuated simultaneously)

Para-meter
Control Preset
Sensor
Limits Values
Display
Select

Para-meter

Text Line		Signification	Possible Value from/to
Yawing : 2		Changing a parameter value results in a temporary parameter group. *Yawing* defines the possible yaw angle and, therefore, the accuracy of heading control. *Rudder* defines the proportional sensitivity of the heading controller. *Cnt. Rudder* defines the differential component of the heading controller with adequate counter-rudder effect.	1 / 6
Rudder : 5			1 / 9
Cnt.Rudder : 5			0 / 9

Control Preset — ***ECONOMY / PRECISION***

Heading Control

Text Line	Signification	Display
Economy / Precision	Selection of the operating mode	E

Control Preset — ***OUICK-TUNE***

Heading Control

Text Line	Signification	Display
M1 : Y2 R5 CR5	Selection of a parameter group Quick-Tune	1
M6 : Y- R- CR -		6

Sensor

Text Line	Signification
– Mag Gyro: 144.2	Request for selection of heading sensor
Man: + 17.2 kts sel	Request for manual speed adjustment
Log: + --.- kts	Indication of log sensor data
Synchr: ---.-	Indication appears only with a heading sensor without coarse shaft or in case of a disturbance in transmission. Request for synchronization between heading sensor and autopilot.

Limits Values

Text Line		Signification	Possible value from / to
Rud. Limit	30°	Defines rudder limitation	5 / 30°
Off Heading	6°	Operating mode *Heading Control*. Defines the heading error alarm theshold (applicable to all NP2015/2025 operating modes)	5 / 30°
Course Trim	5°	Operating mode *Track Control*. Defines the drift correction (applicable to all NP2015/2025 operating modes)	5 / 30°
R.o.T.	30°/Min	Defines the rate of turn, by which a course change manoeuvre is performed	005 / 500°/min
Radius	0.5NM	Defines the turning circle radius for a course change manoeuvre	0,1 / 5NM
Track Lim	556m	Defines the alarm threshold for the X-track range in the operating mode of *Track Control*	0010 / 2000m
Rud. Trim	0°	Defines the angular value by which the rudder blade is turned away from the midship position.	P35°..0 /0.. S35°
Ship load	40%	Defines the case of the variance adjustment.	10 .....100%

Display

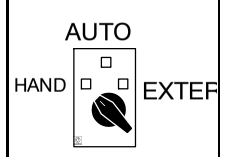
Text Line	Signification
.....	Text line without contents
«	Tendency indication for the preset headind with Heading Control
Man: + 17, 2 sel	Manual speed
PresetHDG: ... 098,0 °	Preset heading with 1/10° indication and setting possibility
XTD: | 0.29NM	Track deviation in NM, on the right or on the left of the track (only possible in the operating mode of track control). In this description, a track deviation of 0.29NM to the right of the track is shown
Setrudder: P 10 °	Current rudder position. **P** for Port, **S** for Starboard

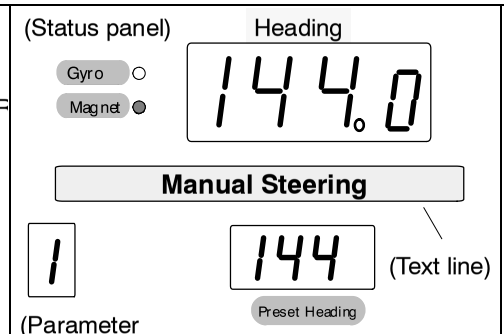
NP2015/2025
Quick Manual

ANSCHÜTZ Autopilot

	Displays	Remarks/ Notes

1 The NP2015/2025 is not active



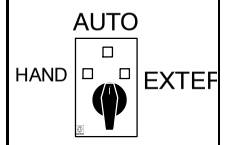


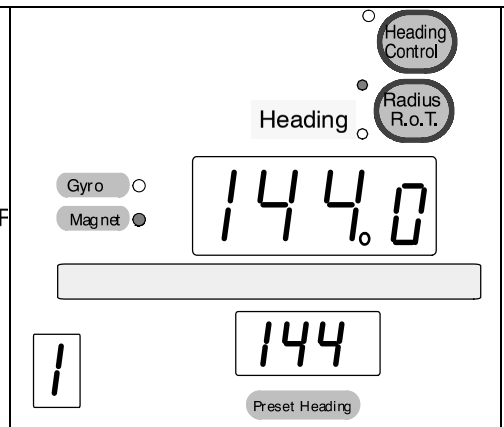
- the steering selector switch is set to **MANUAL**

The following device functions remain as they are:
display heading. .
the preset heading display is automatically adjusted to heading.
display of the current heading sensor.
display of the current heading parameter group.

possible alarm or error messages are shown overlayed in the text line (no acoustic alarm signal!!)

2 The NP2015/2025 is active





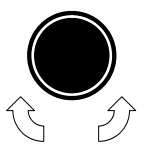
- The steering selector switch must be switched to the **AUTO** setting

The operating condition is as follows:
The NP2015/2025 is automatically switched to the operating mode HEADING CONTROL.
HEADING is accepted as PRESET HEADING preadjustment.
The ship is held on the course of the last effective parameter setting.
A possible course change is travelled with this setting over a preset R.o.T limit value.

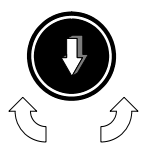
⚠

After switching back (from an EXTERNAL control panel to the NP2015/2025), the radius or R.o.T. limit values of the EXTERNAL control panel are still effective!

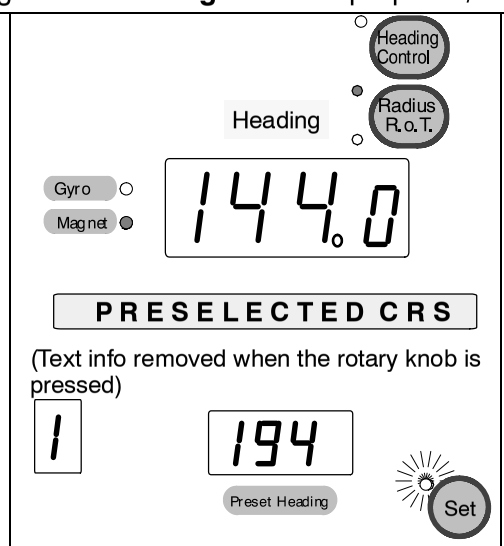
3 Operating mode **Heading control** -prepared/immediate heading change-



or
immediate heading change



depending on the configuration **with or without** an expanded R.o.T. limitation of 120°/min
.



- A preset heading change will be achieved by turning the rotary-knob; this can result in the following possibilities;

<u>For the prepared change of heading</u>
Set the *Preset Heading* by turning the rotary knob.
Actuate the **Set** key.

<u>For an immediate change of heading</u>
Press and turn the rotary knob, the ship will begin at once with the change of heading.
Depending on the configuration, an automatic R.o.T. limitation will be set at120°/min during an R.o.T. maneuver.
This automatic preselection does not apply in case of an R.o.T. limitation which is already >120°/min.

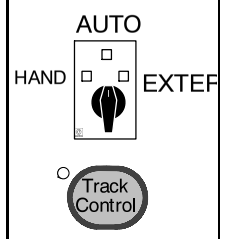
During a heading change, the ship follows always the direction of the set heading user input.

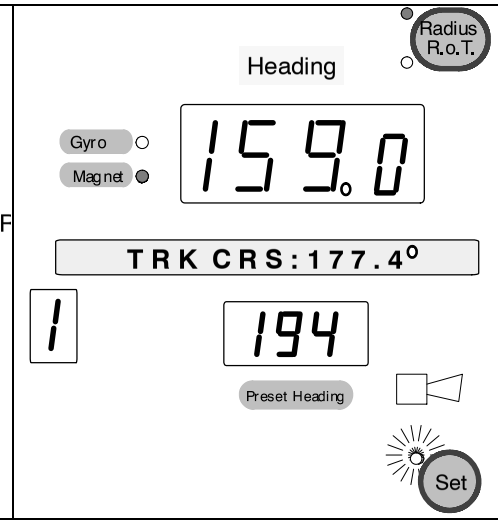
⚠ The change of heading will immediately be started-depending on the pressed rotary knob. The ship begins, e.g. to turn with the preset R.o.T. (**R**ATE **O**F **T**URN) onto the preset PRESET HEADING adjustment.

The following situation results:
The OFF HEADING monitoring is deactivated for the duration of the heading change.
The resulting rudder activity can be displayed via the **Display** key (see section 2.13.4).
The change of heading is completed when the HEADING display corresponds to the PRESET HEADING display.
OFF HEADING monitoring is active.

	Displays	Remarks/ Notes

4 Operating mode **Track control** (**APB** NMEA Telegr.)

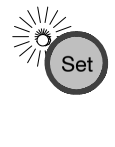


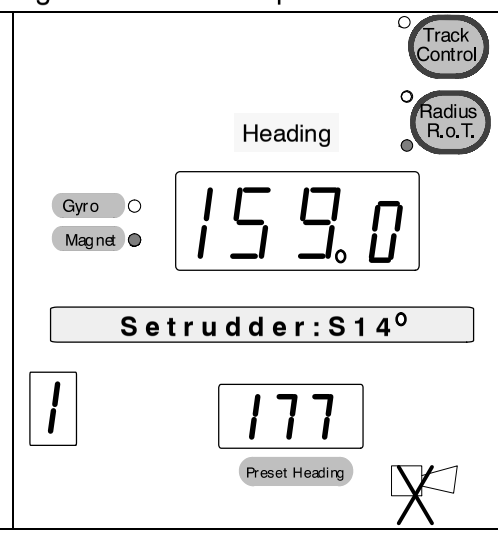


- The steering selector switch is set to **AUTO**.
- The navigation receiver is switched on, the required track section/way point is selected (see system hand book of the navigation receiver).
- By actuating the key the track control operating mode is preselected. The NP2015/2025 checks the heading position vis-a-vis the track/way-point and the heading position vis-a-vis the track monitoring limit. The track control operating mode is made available for the journey when:
  the heading position of the track is < 60° (alternative error message *course* > 60°, correction via the heading control operating mode).
  The heading position is within the track monitoring limits (alternative error message *Dist.*> *Tr. Limit,* correction via the heading control operating mode)

The following situation results:
The track course is displayed within the text lines. The acoustic signal is emitted. The LED of the **Set** key flashes.

5 Accepting the track course preselection

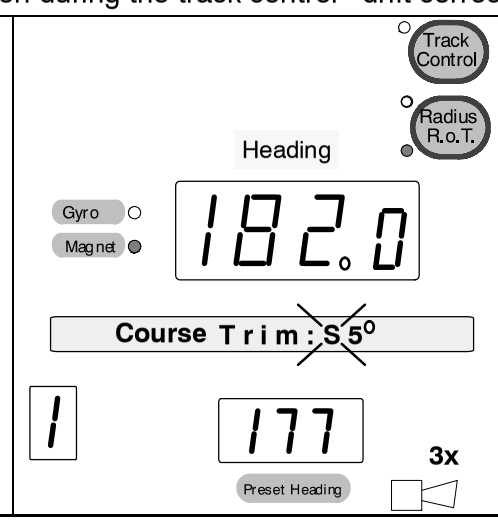




- on actuating the **Set** key, the received track course changes to set course and the *set course* display is shown.

The following situation results:
- the track control activates, the acoustic signal is deactivated
- the **Off Heading** monitoring is deactivated.
- the **Track Lim** monitoring (track tube) is active.
- the rotary knob function is cancelled with transmission of the APA, APB, PRAPA, HSC, HTR, HRA, NMEA Telegr.
  a track course manoeuvre is recognized by the track planning system (e.g. GPS receiver) and transmitted to the NP2015/2025 in the form of a new track course selection (for dialogue see item 4).
- the rotary knob function remains the same if the track course will not be transmitted. The new track course must be read out via the track planning system and set at the NP2015/2025 with the rotary knob.

6 Situation during the track control -drift correction-



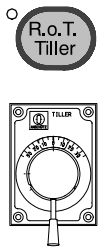
- the navigation receiver senses a drift towards the side and transmits this information to the NP2015/2025.

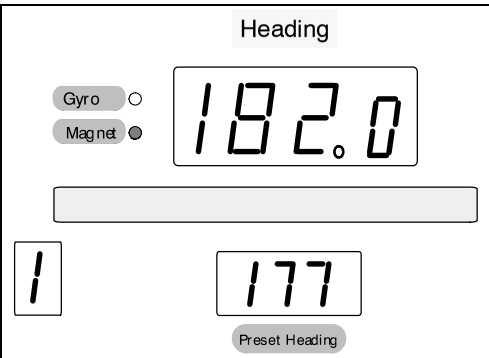
The following situation results:
The ship is automatically turned against the drift.
The maximum lead angle has been fixed by the Course Trim value(5° min....30°max.).
An alarm will be generate if the lead angle is too less.
To modify a knew value choose the function Limits Value.

NP2015/2025
Quick Manual

	Displays	Remarks/ Notes

7 Operating mode **R**ate **o**f **T**urn Tiller





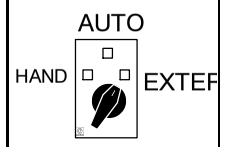
- This operating mode requires an external R.o.T. Tiller.
  The tiller is ready for use on actuating the key.

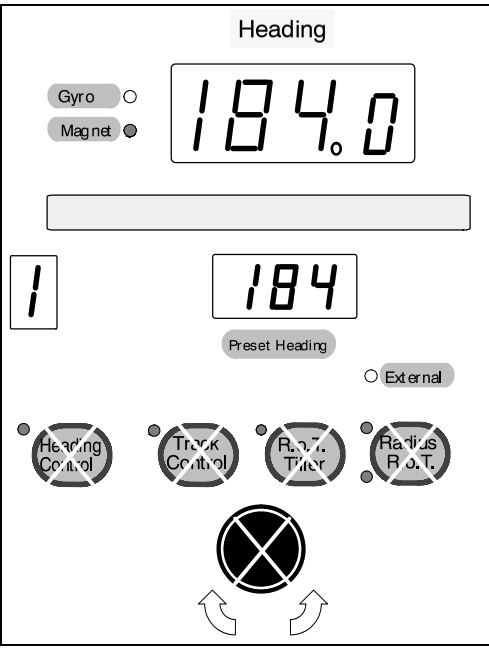
The following situation results:
- The limit value setting (for Radius or R.o.T.) is switched off during the time the R.o.T. Tiller is steering the ship.
- Every tiller adjustment is immediately effective
  The tiller operation can be cancelled at any time by actuating the command key.

The turning speed will be determined by the turning behaviour of the ship and the set parameters.

Turning behaviour with preset rudder limitation:
If the set R.o.T. is not reached due to the rudder limitation, the rudder limitation may only be increased in steps (in steps of <5°).
Otherwise, the R.o.T. might be considerably exceeded as a result of the integral content of the controller.

8 Operating mode **Remote**



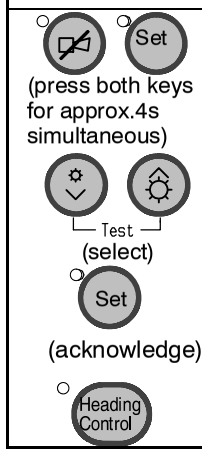


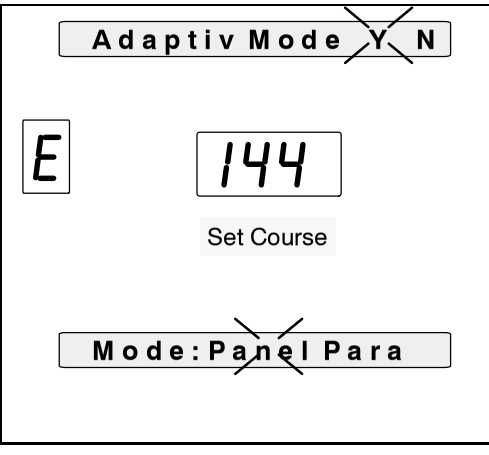
- The steering selector switch is in the EXTERNAL position.
- The NP2015/2025 is guided by a previously connected control panel with serial transmitted set heading values.

The following situation results:
- The following displays remain unaffected:
  - Preset Heading / heading
  - Heading sensor
  - Alarms (without a signal sound)
  - Current parameter groups
  - Preset info in the text line
- Limits to operation
  - Command keys are locked.

The values preset at the NP2015/2025 for R.o.T. or radius are overwritten by the external values. After switching back (e.g. to *Heading Control)* check whether the external values for R.o.T or Radius (which are still valid) assure a safe heading or track change!

9 Select the individual function (**Economy**/**Precision** or **Basic *Quick-Tune***) (only NP2025)

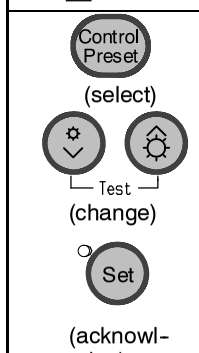


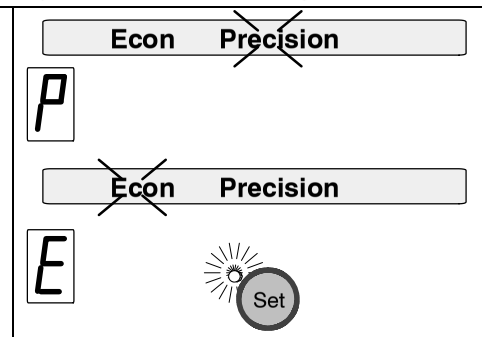


- After approx. 4s the textline will be changed.
- Select the individual mode
  Y ⇒ ECONOMY ⇒ Display shows e.g. **E**
  N ⇒ BASIC ⇒ Display shows e.g. **1**.Parameter Group
- The display shows the current mode after acknowledgment of the required of setting :
  Panel ⇒ Operator unit configuration
  Para ⇒ System configuration
- A RESTART is automatically triggered by pressing a function key or command key. The NP2025 works in the individual mode.

	Displays	Remarks/ Notes

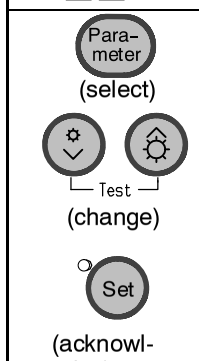
10 **E**conomy or **P**recision **(Only NP2025)**

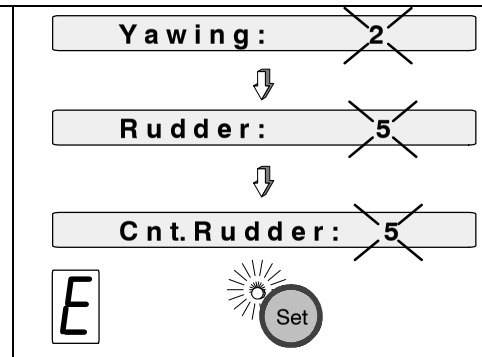




- On actuating the key both operating modes will be displayed. The flashing display shows the active operating mode.
- Switch over the mode of operation on the text line by pressing a key
- The change becomes effective on acknowledgement (Set key).

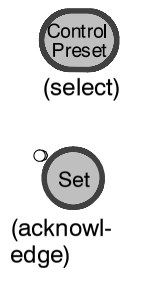
11 Parameter of e.g. **E**conomy call/change

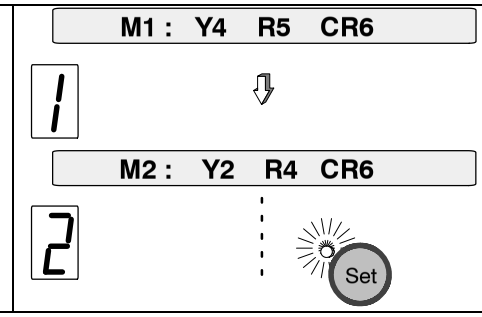




- On actuating the key, the first parameter is displayed. On re-actuating the key, the next parameter is displayed.
- After being called up, the parameter value can be changed
- The change becomes effective on acknowledgement (Set key).

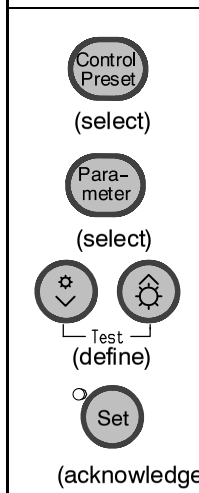
12 Calling up Parameter groups (preselected function **Basic *Quick-Tune***)

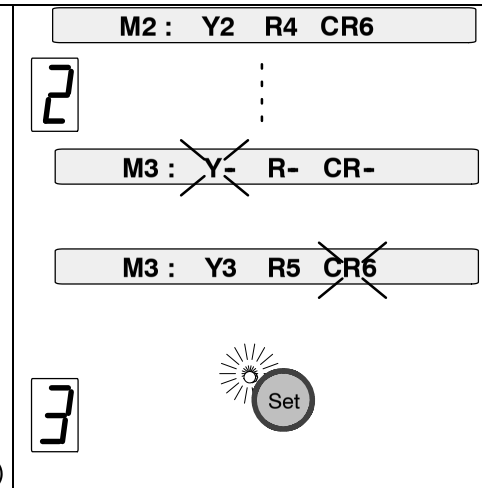




- On actuating the key, a parameter group can be called up that is effective for the operating modes *Heading Control*, *Track*, *R.o.T* or *Remote*
- Selection is completed by an acknowledgement; the parameter then becomes effective.

13 Defining the parameter group (preselected function **Basic *Quick-Tune***)





- The unset parameter group is called up by actuating the key.
- The respective parameter is selected by actuating the key (**Y**awing, **R**udder, **C**oun**t**er **R**udder)
- the parameter value can be set by actuating one of the keys.
- On actuating the key, the parameter group is saved. The parameter values of a group can be changed at any time. The operating procedure is the same.

NP2015/2025
Quick Manual

	Displays	Remarks/ Notes
1 4 Display test		
AUTO HAND EXTER Test	Heading Control Track Control R.o.T. Tiller Radius R.o.T. Heading Gyro Magnet External Preset Heading Set	Before the display test can be carried out, the steering selector switch must be set to MANUAL. The test is displayed after pressing the keys simultaneously. The following are tested: - All displays (7 segment display) - Status displays - Status displays of the keys - All display elements The text lines (16 pieces) - Acoustic signals - Bus adress The test lasts approx. 10 seconds; afterwards, the last valid display surface re-appears. ⚠ If an error is recognized on visual inspection, R.A. Service **must** be notified for REASONS OF TECHNICAL SAFETY!

NP2015/2025
Quick Manual

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ANSCHÜTZ

NAUTOGUIDE B - track control

For Multiple straight leg track control with assisted turns between legs with ECDIS and Autopilot NP2015/NP2025 (NP2010/NP2020)
- according IEC 62065, Category B

OPERATOR MANUAL

3677.DOC012 Edition: Feb. 05, 2004

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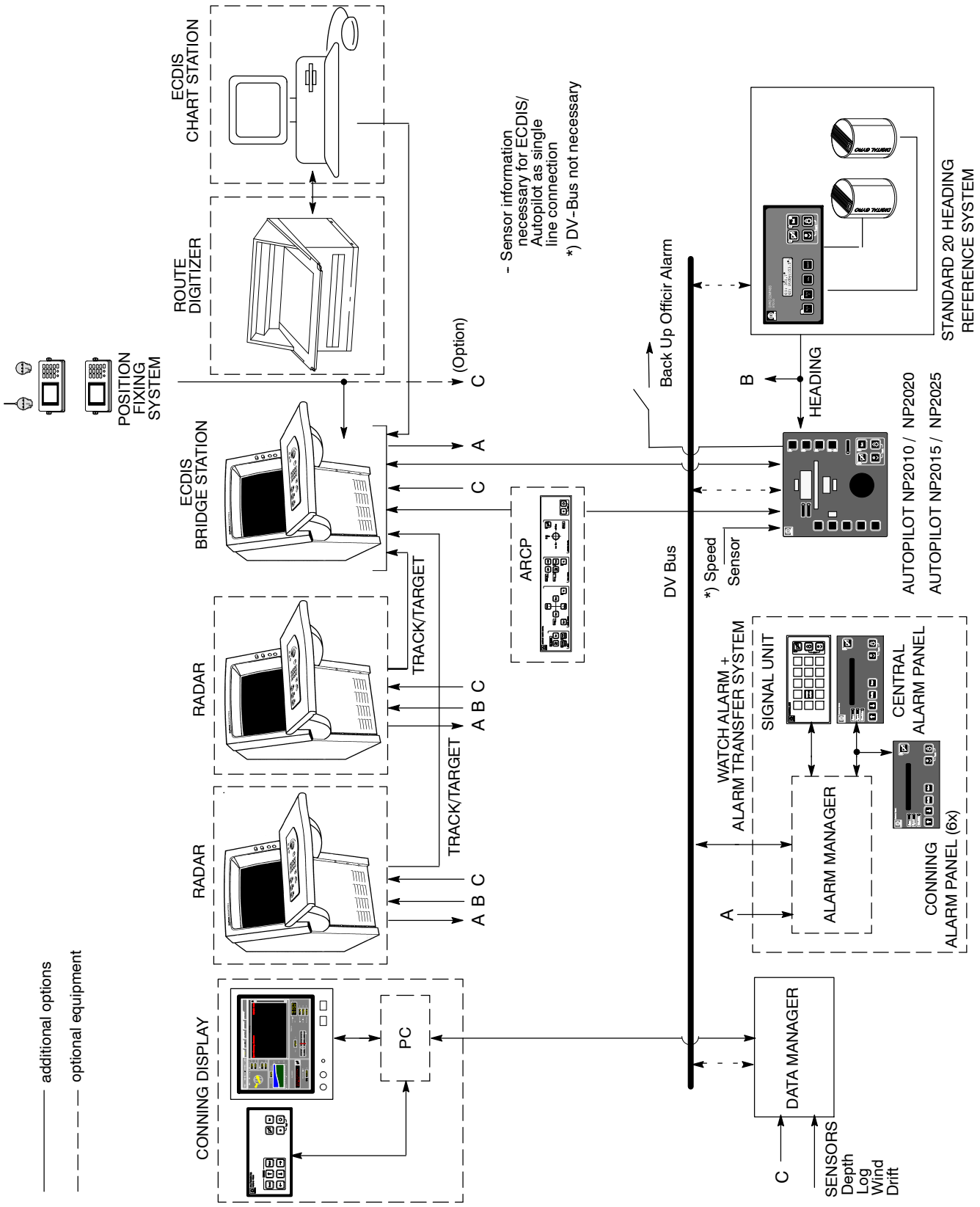
Alarm table

Short operation

1 General


ECDIS CHART STATION
ROUTE DIGITIZER
POSITION FIXING SYSTEM
ECDIS BRIDGE STATION
RADAR
RADAR
CONNING DISPLAY
PC
ARCP
TRACK/TARGET
TRACK/TARGET
A B C
A B C
A
C
C
(Option)
- Sensor information necessary for ECDIS/ Autopilot as single line connection
*) DV-Bus not necessary
Back Up Officir Alarm
DV Bus
*) Speed Sensor
B
HEADING
STANDARD 20 HEADING REFERENCE SYSTEM
AUTOPILOT NP2010 / NP2020
AUTOPILOT NP2015 / NP2025
WATCH ALARM + ALARM TRANSFER SYSTEM
SIGNAL UNIT
CENTRAL ALARM PANEL
ALARM MANAGER
CONNING ALARM PANEL (6x)
DATA MANAGER
C
SENSORS
Depth
Log
Wind
Drift
additional options
optional equipment

1.1 Main Components of the Track Control System

The Track Control System Nautoguide is a Track Control System according IEC 62065 Category B.

The main components of the Track Control System are:
- ECDIS BRIDGE STATION
- DATA MANAGER or direct sensor input to ECDIS/Autopilot
- AUTOPILOT NP2010/20 or NP2015/25
- STANDARD 20/22 Heading Reference System
- POSITION FIXING SYSTEM
- LOG

Optional equipment:
- ECDIS CHART STATION
- ROUTE DIGITIZER
- NAUTOCONNING DISPLAY
- ALARM MANAGER
- AUTOPILOT REMOTE CONTROL PANEL, ARCP
- ADDITIONAL SENSORS

1.1.1 Short Description of Main Components

ECDIS BRIDGE STATION

Pathfinder/ST ECDIS is an integrated navigation system with advanced electronic chart capabilities including: route monitoring, route planning, look ahead and other navigational tasks. It enables a navigator to conveniently do all navigational routines which are currently done on paper charts.

Pathfinder/ST ECDIS's advanced route planning capabilities make it easier for the navigator to set waypoints and create routes, name and save your routes so you can use them again, or navigate to a waypoint that you've stored in your navigation device. Pathfinder/ST ECDIS features waypoint and cross–track error alarms to assist you while navigating.

AUTOPILOT NP2010/NP2020 or NP2015/NP2025

The NP2010/NP2020 or NP2015/NP2025 is a modern adaptive autopilot system designed for all sizes of sea-going ships.

The NP2010/NP2020 or NP2015/NP2025 has the following operating modes:

- Heading control in consideration of a radius or R.o.T limit value adjustment
- Track control in conjunction with an ECDIS system
- Rate-of-turn control via an R.o.T. tiller

NP2010/NP2015

The steering quality has to be adjusted by using the parameter rudder, counterrudder and yawing. Track change will be done by heading control with preset Radius/R.o.T.

NP2020/NP2025

Depending on requirements, the operator can adapt the steering quality to present sailing area by selecting between Economy, Precision and Basic.
Track change will be done by heading control with preset Radius/R.o.T.

1.1.2 Short Description of Optional Components

ARCP

The ARCP is an additional control panel for the autopilot NP2010/NP2020 or NP2015/NP2025 family in combination with an ECDIS.
It has the following functions:

- Change-over between heading control and track control
- Changing the preset heading (set course) during heading control
- Changing the turn radius during heading control
- Autopilot override by means of an override tiller

NAUTOCONNING

NAUTOCONNING is the central display and data and alarm management system for the ship's command.
A NAUTOCONNING system consists of:

- Data manager
- Conning display
- Alarm manager with alarm panels

Tasks and performance features:

Data Manager:

- Registration and adaptation of sensor data (Compass, Autopilot, ECDIS, etc.)
- Registration and preparation of navigational data (Log, NavRec, Wind, Depth, etc.)
- Selection from between redundant sensors (GPS receivers)

Conning Display:

- Display of the registered data, alarms and procedure sequences (tracking) in corresponding monitor screens
  (NAVIGATION, DOCKING, SENSORS, RECORD, ALARM)

Alarm Manager:

- Registration and management of alarms and system conditions
- Distribution of the data and alarms to connected elements

ECDIS CHART STATION with ROUTE DIGITIZER

The ECDIS CHART STATION intended primarily for route planning and monitoring has a high resolution colour display. It could be combined with a digital chart table (large format digitizing table).

By placing a sea chart on the tablet‘s surface and digitizing a planned route on the chart the coordinates of the waypoints are converted into digital format and saved in the ECDIS System. On the ECDIS BRIDGE STATION the stored route can be displayed and used for track control.

1.2 Function

Heading Control

The adaptive heading controller can be operated from autopilot operator unit as well as from ECDIS console integrated Autopilot Remote Control Panel (ARCP). A take-over system between ARCP and autopilot makes it possible to change during heading control the preset heading and radius settings via the ARCP. The preset heading and the radius are displayed at the ECDIS.

An override of heading control can be carried out by a NFU tiller on the active ARCP.

Track Control

ECDIS BRIDGE or CHART STATION with or without DIGITIZER generated routes can be used for automatic track keeping. The track control function can be activated at the ARCP.

An override of track control can be carried out by a NFU tiller on the active ARCP.

Data Management

All navigation information (heading speed, position, depth, wind, drift) is managed by NAUTOCONNING. In case of several sources of the same type of data (e.g. position), the data are selected and distributed throughout the system. Thus all information for the track control system is provided centrally by NAUTOCONNING. In case of data failure an alarm is generated.

Heading Distribution

The heading information is distributed by the gyro compass STANDARD 20/22 system. Systems which require a high update rate (autopilot, RADAR) receive the heading information via the course bus. Indication and monitoring devices (NAUTOCONNING) receive the heading information via the Data Distribution bus.

The heading reference (Gyro 1/Gyro 2/Magnetic compass) is selected at the NAUTOCONNING or at the operator unit(s) STANDARD 20/22.

Position Distribution

The position information is read in at the ECDIS and transmitted to the Data Distribution bus (Option). NAUTOCONNING or ECDIS takes over the selection of the system master position. NAUTOCONNING and RADAR receive the position via the data manager. STANDARD 20/22 receives the position via the Data Distribution bus. The autopilot gets it directly from the ECDIS.

Speed Distribution
The speed information is read in and managed centrally at the NAUTOCONNING. NAUTOCONNING also takes over the selection of the speed sensor. The speed information is distributed via the Data Distribution bus and via the data manager.

Sensor Data Distribution (Wind, Depth, Drift, etc.)
These data are read in and managed centrally at the NAUTOCONNING. A selection between different sensors is not possible. The sensor data are distributed via the Data Distribution bus and via the data manager.

Alarm Management
The alarm manager as an independent unit in the NAUTOCONNING permits – besides the input and display of external alarms (binary contacts) – protocolling on the NAUTOCONNING and distribution and signaling on its own signal units via serial data bus. Subsidiary to it is a watch alarm system which monitors the connected navigation equipment (RADAR, ECDIS, autopilot etc.) for proper operation and, in addition to the reset buttons, resets the watch alarm. When the prescribed period of time has elapsed, alarms are given according to the rules of the IEC 62065 on up to the general alarm (normally–closed contacts).

Conning Display
The conning display is part of the NAUTOCONNING SYSTEM. It receives the data and alarms off all devices and sensors connected to the system and displays them on a monitor.

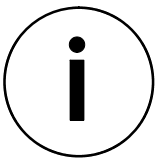
2 Operation

2.1 Safety Notes

The safety notes given in the descriptions of ECDIS and autopilot NP2015/NP2025 series are to be observed in every detail.

Warning!
Automatic steering modes (course control, track control) may be used, when the expectable steering accuracy complies with the traffic and navigational situation.
Special care must be taken in confined and congested waters.

Notes on the use of the membrane keyboard:

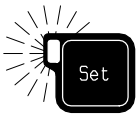


The operator unit NP2010/NP2020 or NP2015/NP2025 series is equipped with a membrane keyboard. In order to protect the membrane from mechanical damage, it should never be operated with sharp implements such as screwdrivers, pencils, etc.

2.2 Explanation of Used Symbols

Note:
Selected functions are written in bold, buttons to be operated are written in italic and messages (display) are set into quotation marks.

Key actuation



LED *flashing*

LED *out*

LED *alight*

Audible signal *on*

Audible signal *off*

ECDIS display alarm messages in the area

Fig. 1-1 Message Display Area

2.3 Route Planning

There are 3 different possibilities to generate a route on ECDIS.

- *Using official chart data:* Route planning direct on ECDIS (Bridge or Chart station)
- *Manual input:* Using official paper charts taking waypoint coordinates out of the paper chart and enter coordinates manually via keyboard in ECDIS (Bridge or Chart station)
- *Digitizer input:* Using official paper charts together with the digitizer to enter waypoint coordinates into ECDIS.

This section (2.3) contains:

- Route Planning Digital Chart Data (see section 2.3.1).
- Route description (see section 2.4).
- Edit Route Command (see section 2.5).
- Creating a new Route (see section 2.5.1).
- Planning a Route using the ECDIS with Digital Chart Data (see section 2.5.2).
- Planning a Route using the ECDIS with manual coordinate input (see section 2.5.3).
- Route Planning with ECDIS and Digitizing table (see section 2.5.4).
- Track Control (see section 2.6).
- Loading Route (see section 2.7).
- Checks to be made before switching ON the Track Control (see section 2.8).
- Displaying the GO-TO-Waypoint of a Route (see section 2.9).
- Activating Track Control at ECDIS (see section 2.10).
- Activating Track Control at ARCP (Option) (see section 2.11).
- Track Change Manoeuvre (see section 2.12).
- Track End (see section 2.13).
- Interruption of Track Control by the User (see section 2.14).
- Reactivating Track Control after user interruption (see section 2.15)
- Interruption of Track Control in case of a Defect (see section 2.16).

2.3.1 Route Planning Digital Chart Data

ECDIS has sophisticated route planning capabilities.

During route planning, each route section is automatically checked for free and safe passage of the ship. The automatic check-up comprises Prohibited Areas, Own Ship's Contours, Buoys and Beacons known from and indicated in the sea charts (93/3 and S57).
In case a dangerous situation is realized during route planning, a corresponding alarm is

displayed in the Alarm Window (see Fig. 1-1).
ECDIS displays waypoints as circles. The active waypoint is marked with an additional circle around it. If you label your waypoints, the labels appear below the marker. When a route is established, the following information is automatically displayed:

1. A planned track (course line) between the waypoints (is red in colour and appears as a thick dashed line between waypoints and a dashed line between the ship and the active waypoint).
   Using the route planning feature, a primary as well as a secondary route can be created (see section 2.5). The route priority can be selected via menu function as needed.

   The primary route is displayed in thick, red, dashed lines.
   The secondary route is displayed in thin, red, dashed lines.

2. The planned turning arc/radius (red in colour); the turning arc which was established when you entered the waypoint.
   The turning arc/radius is limited to maximum 135°.
   This limit value is checked during route planning and if this limit is exceeded an error message is released.

3. Crosstrack limit boundaries: width defined by the current cross-track error alarm setting.

4. The wheelover point, or the point at which own ship must start turning to follow the predicted turning arc.
   The wheelover point position is controlled by the “Turning Response” box in the Autopilot dialogue box. Please see ”Driving an Autopilot” in the ECDIS operation manual section 12.1.10.

2.4 Route Description

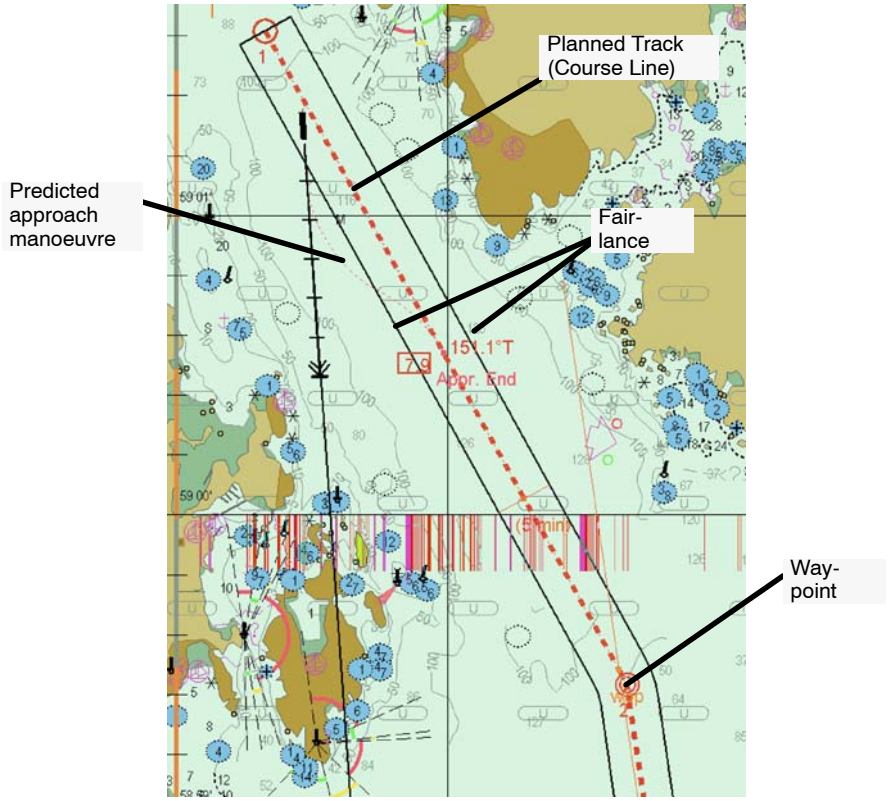


Fig. 1-2 Route Description

ECDIS does not select an active waypoint until the Steer to Track dialogue box has been opened and the active waypoint has been selected.

2.5 Edit Route Command

The Edit Route command allows you to do the following:

- Enter and label waypoints
- Move waypoints or change their labels
- Delete waypoints from a route
- Enter and change the planned turn radius/arc
- Insert new waypoints in a route
- Reverse the order of waypoints in a route
- Name and save a route

When you choose the **Edit Route** command, ECDIS displays the Edit Route dialogue box with the name of the open route in the title bar. If you are creating a new route, the title bar reads *untitled*.

Planning a route is simply entering waypoints. You can use the **Edit Route** command to enter a waypoint in two ways:

1. Positioning the cursor in the display.

2. Using the Latitude and Longitude boxes to enter specific coordinates.

While you are entering waypoints, Pathfinder/ST ECDIS automatically checks the route and fairlane (cross track limits) for unsafe and restricted areas as well as to check if they are reasonable (relative to their geometrical coordinations). If the fairlane or route is not reasonable, and cannot be created, one of the two following message boxes will appear, Fig. 1-3.

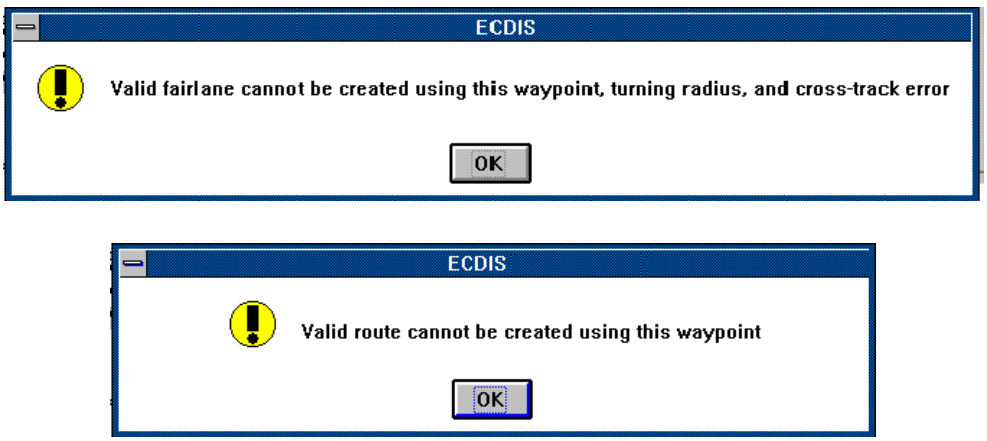

ECDIS
Valid fairlane cannot be created using this waypoint, turning radius, and cross-track error
OK
ECDIS
Valid route cannot be created using this waypoint
OK

Fig. 1-3 Route Warning Messages

When these message boxes appear, you will not be allowed to enter this part of the route. Acknowledge the message box by clicking on *OK*. If the route action is not accepted, you must change the location of the waypoint. If the geometrical limits are not accepted, you may either change the waypoint, waypoint radius, or the Cross–track Error Alarm (you may leave the Edit Route dialogue box open while you do this).

If you enter a waypoint in a restricted area, ECDIS will display a warning “Route Intersects Restricted Area”. ECDIS allows you to save routes containing a waypoint in a restricted area.

Handling Primary Route and Secondary Route

The ECDIS is able to display two routes at the same time:

- the first route which has been created or loaded is defined as “Primary Route”
- the second route which has been created or loaded is defined as “Secondary Route”.

Route priorities are indicated by the entry Primary and Secondary in the menu guide (see ECDIS operator manual section 8.1.13).

When starting the Edit Route mode the operator is asked to select the Primary or Secondary route, if more than one route has been loaded.

If Track Control is active a modification of the active (Primary) Route is possible. During this time the Secondary Route is faded out.

If the Primary Route is deleted by means of the function **Clear Route**, the Secondary Route becomes the Primary Route

2.5.1 Creating a new Route

Note

NOTE

In general it could be said: The larger the chosen scale of the displayed chart, the more accurately you can locate specific coordinates. If you want to place a waypoint at a location that is not in view, you can move the display using the Zoom feature, the Scale and Center command, the View Area command or the arrow keys while the Edit Route dialogue box is open. For further details see ECDIS operator manual.
Observe the Alarm Window (Information Panel), consider the messages about: Prohibited Areas, Own Ships Contours, Buys and Beacons.

Select the desired chart area for the route planning.

1. Select **Edit Route** from the Routes menu or use Keystrokes <*Alt*+*R*+*E*>.

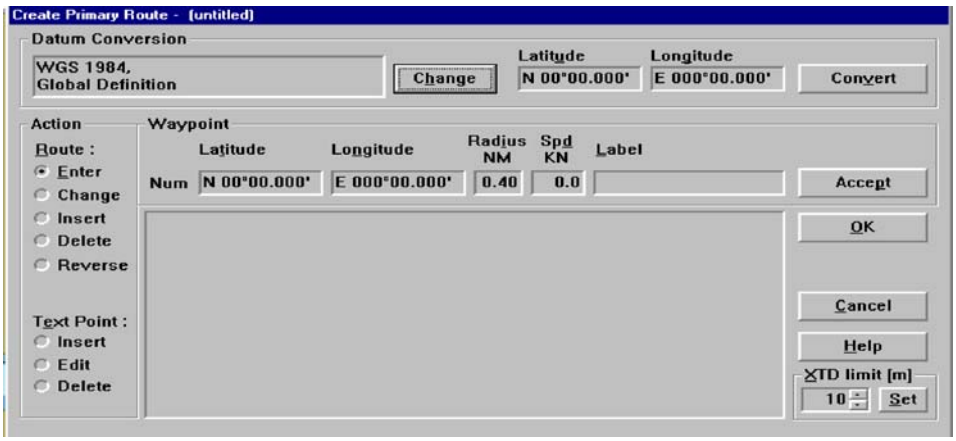


Fig. 1-4 Creating a new Route

2. Select either by cursor or by numerical input of *Lat/Long* the first waypoint position, press the *Enter* key or click on the *Accept* button.
   The waypoint number and the waypoint coordinates are shown in the dialogue window.
3. Select either by cursor or by numerical input of *Lat/Long* the next waypoint as described under item 1. If the waypoints are more than 200NM away from each other, Great Circle Navigation will be considered (see ECDIS operator manual section 8.1.4).

4. By clicking the *OK* button, route planning is finished. The route can now be saved under any name.

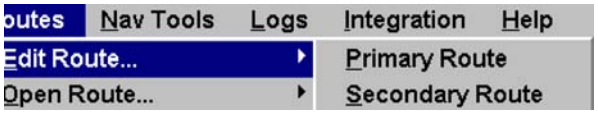
Alarm overview for areas which the ECDIS detect and indicates in the Alarm Window:

Traffic separation zone
Traffic routing scheme crossing or roundabout
Traffic routing schema precautionary area
Two way traffic route
Deep-water route
Recommend traffic lane
Inshore traffic zone
Fairway
Restricted area
Caution area
Offshore production area
Areas to avoided
Military practice area
Seaplane landing area
Submarine transit lane
Ice area
Channel
Fishing ground
Fishing prohibited
Pipeline area
Cable area
Anchor prohibited
Dumping ground
Spoil ground
Dredged area
Cargo transshipment
Incineration area
Special protected areas

2.5.2 Planning a Route using ECDIS with Digital Chart Data

Note

1. Select **Edit Route** from the Routes menu or use Keystrokes <*Alt*+*R*+*E*>.



Select **Primary Route** or **Secondary Route** to open the Route dialogue box.

If Track Control is active the following dialogue box appears:

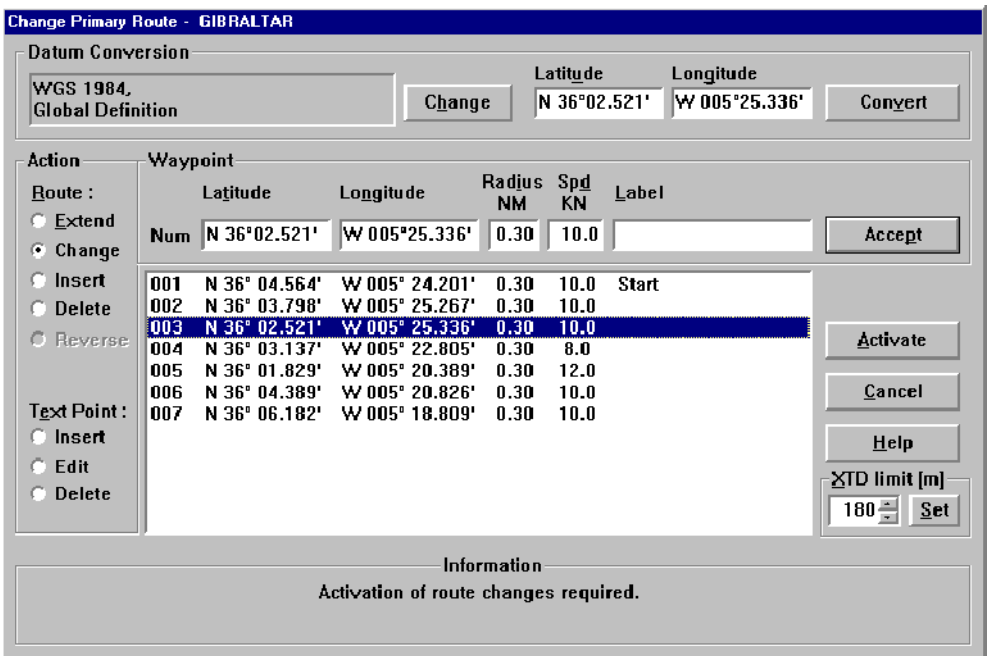


Fig. 1-5 Edit Route / Active Route Dialogue (Track Control active)

When having the route modifications finished, the modified route has to be activated by the *Activate* button. The text field at the bottom of the dialogue box (Information) displays corresponding messages.

If Track Control is not active the following dialogue box appears:

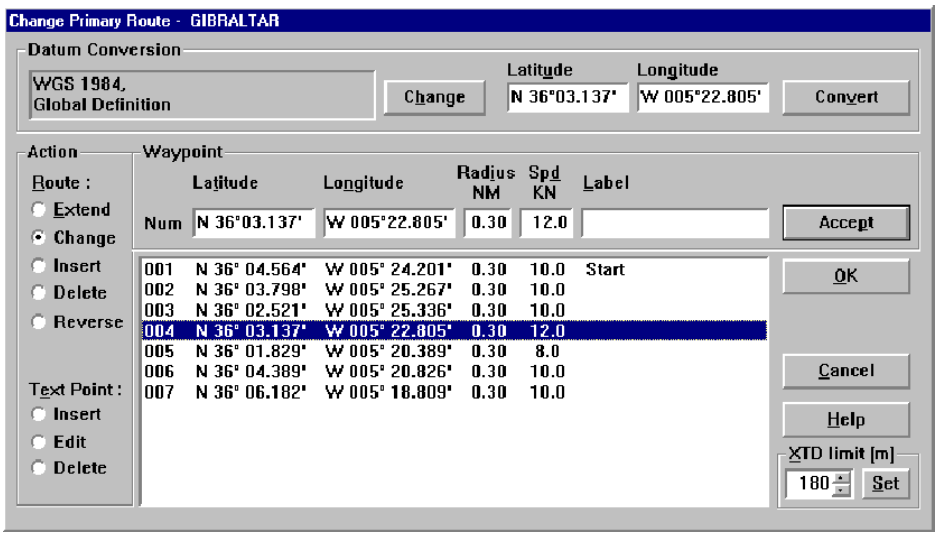


Fig. 1-6 Edit Route / Active Route Dialogue (Track Control not active)

Current changes are confirmed by the *OK* button. Differing from the above mentioned dialogue box there is no Information text field and no *Activate* button.
The dialogue box is closed using the *OK* button.

Note

You can either enter a label and a turn radius before you place the waypoint, or you can go through the Change Waypoint process to add one later.

1. Label the waypoint by typing a label of up to 10 characters in the Label text box.

2. Enter a turn radius for the waypoint by clicking in the Radius text box and entering the desired value.

3. Position the target cursor at the desired location for the waypoint and click. A way point symbol appears in the display.

Note

Datum is always WGS 1984.

4. To enter additional waypoints, repeat steps 2 – 4.

On the ECDIS a waypoint symbol appears at each location you click on and the route is completed with fairlanes and the planned track leg. (solid line).

5. To enter a cross-track error, click in the XTD text box and enter the cross-track limit in m. Click on *Set* to make the change. The fairlanes on the display will be adjusted according to the cross-track limit settings.

6. Click on *OK*. The Save Route dialogue box appears, Fig. 1-7.

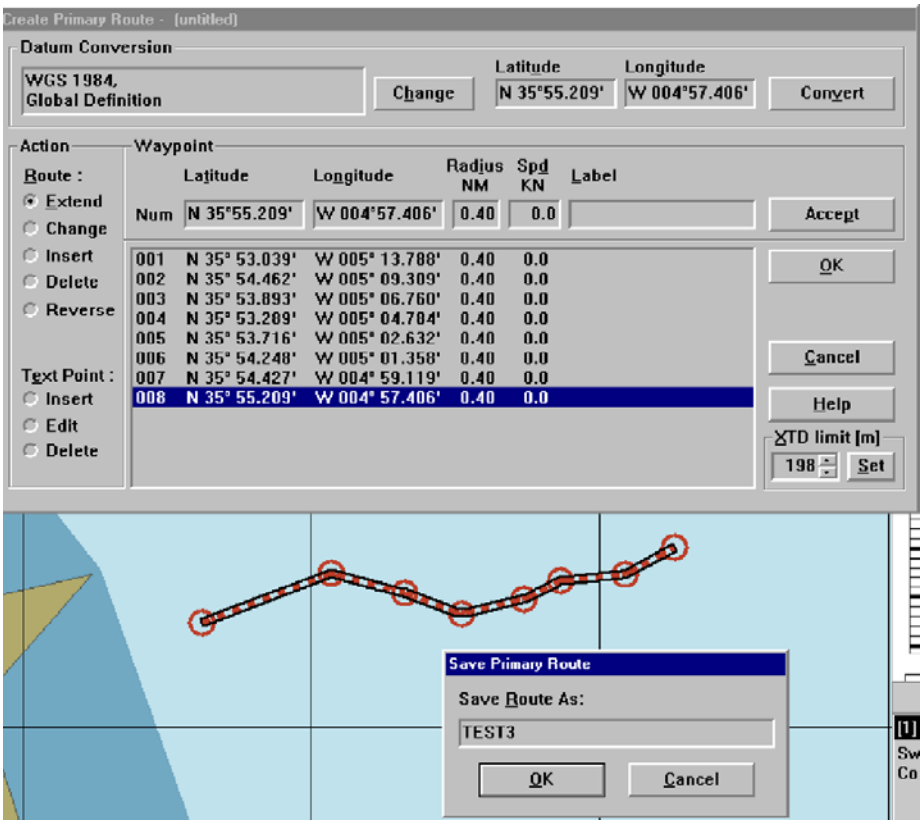


Fig. 1-7 Save Route Dialogue Box

Note

If you are entering a route which intersects a restricted area, Pathfinder®/ST ECDIS will not prompt you to save it. You may save the route by selecting **Save Route** from the Routes menu.

7. To save the route, type a name of up to 25 characters in the text box, then click on *OK*. If you do not want to save the route, click on *Cancel*.

Note

The value for the turning arc/radius is limited to 135°. If this Limit is exceeded while planning a route a message window pop-up giving respective information.

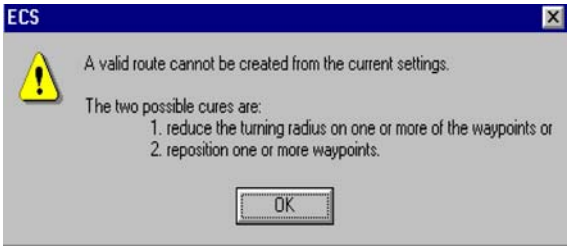

ECS
A valid route cannot be created from the current settings.
The two possible cures are:
1. reduce the turning radius on one or more of the waypoints or
2. reposition one or more waypoints.
OK

Fig. 1-8 Pop-up when turn arc/radius greater than 135°

2.5.3 Planning a Route using the ECDIS with manual coordinate input

1. Select **Edit Route** (primary or secondary) from the Routes menu or use Keystrokes *<Alt+R+E>.*
   The Edit Route dialogue box appears with the action “Enter” selected, Fig. 1-9.

> **NOTE**
> You must either enter a label and turn radius before you place the waypoint, or you can go through the Change Waypoint process to add it later.

2. Select *change* button next to the datum list box and scroll through the pull-down to select the datum of the chart from which you read off the waypoint (latitude/longitude).
3. To enter the latitude and longitude of a waypoint, type in the coordinates, (hemisphere,degrees and minutes). If you express minutes to a tenth, hundredth or thousandth of a minute, be sure to include a decimal point (.).
4. Label the waypoint by typing a label of up to 10 characters in the Label text box.
5. Enter a turn radius for the waypoint by clicking in the Radius text box and entering the desired value.
6. Click on *Convert* to convert the waypoint‘s datum into WGS1984 datum.
   The converted coordinates appear in The Edit Route dialogue box, Fig. 1-9.

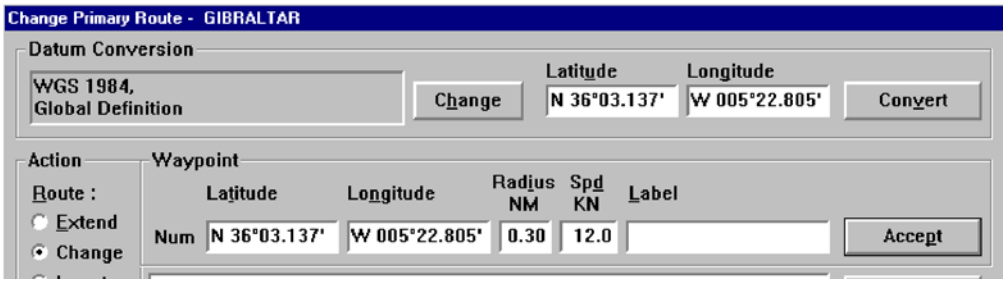


Fig. 1-9 Edit Route Dialogue Box

7. Click on *Accept*. The waypoint appears in the waypoint list, and a waypoint symbol appears in the display.

8. To enter additional waypoints, repeat steps 2 - 7. A waypoint symbol appears at each location you specify and the route is extended with fairlanes and a planned track (dashed).

9. To enter a cross-track error, click in the XTD text box and enter the cross-track limit in m. Click on *Set* to make the change. The fairlanes on the display will be adjusted according to the cross-track limit settings.

10. Click on *Quit*. The Save Route dialogue box appears, Fig. 1-7.

Note

If you are entering a route which intersects a restricted area, ECDIS will not prompt you to save it. You may save the route by selecting **Save Route** from the Routes menu.

11. To save the route, type a name of up to 25 characters in the text box, then click on *OK*. If you do not want to save the route, click on *Cancel*.

2.5.4 Route Planning with ECDIS and Digitizing Table

If your system is equipped with a digitizing table waypoint coordinates could be read in from paper chart into the ECDIS system for further use.

For that procedure the it is necessary to

- enter paper chart details (name, scale, datum, offset, type of projection etc.)
- align the paper chart on the digitizing table
- enter waypoints with puck of the digitizing table
- enter route name while saving route process.

(Further information is given in ECDIS operator manual, section 4).

2.6 Track Control

There are several conditions to be met for activating track control:

- a route is to be created with official chart data
- the route has to be loaded
- the ship is to be brought into an area close enough to pre-planned track
- the automatic steering mode is required
- the Start Waypoint of the route has to be selected
- the type of track approaching manoeuvre has to be chosen:
  GO-TO-Waypoint or GO-TO-Track)
- the approach radius is to be selected and
- track control has to be activated

In section 2.7 and following, the above mentioned steps are described precisely.

Approach manoeuvre types

The system offers two different types of approach manoeuvres

- the GO-TO-Waypoint manoeuvre
- the GO-TO-Track manoeuvre.

For a better understanding the difference between the two types of track approach manoeuvres are described in the following.

GO-TO-Waypoint manoeuvre (see Fig. 1-10)	**GO-TO-Track manoeuvre** (see Fig. 1-11)
The main idea behind the GO-TO-Waypoint manoeuvre is, that the selected GO-TO-Waypoint is crossed. The start point is thought to be laid in free water to enter narrow water without any risk. The geometrical restrictions to be followed are shown in the a.m. figures.	The GO-TO-Track manoeuvre is the standard approaching manoeuvre. It is used when a route should be entered not at the beginning or entering a route after a track control interruption carried out by the operator. The following geometrical restrictions are to be met.

GO-TO-Waypoint manoeuvre

The GO-TO-Waypoint approach manoeuvre is designed to sail into the pre-planned track by sailing over the selected start waypoint.
Consider the initial heading!
Actual heading and bearing TO-WPT must be lower than 60°.

The initial position must be ”before” the track and should be less than 10 nautical miles away (see Fig. 1-10).

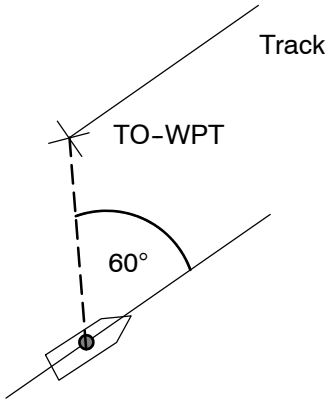


Fig. 1-10 Initial position

GO-TO-Track manoeuvre

The **GO-TO-Track** approach manoeuvre is designed to start the track control at a track leg where the start waypoint is already passed. This may apply when entering a route first time or re-entering a route after interrupting track control (see Fig. 1-11).

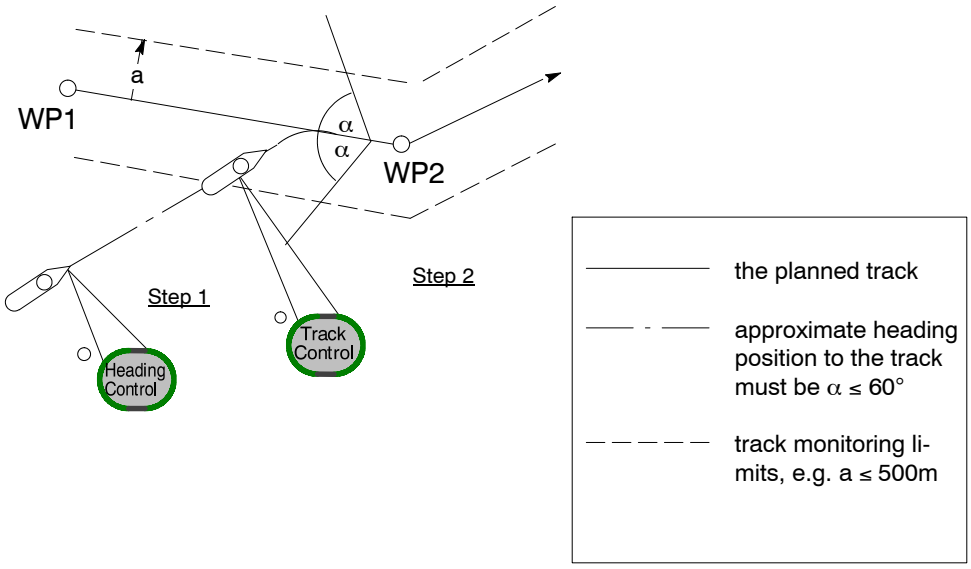


Fig. 1-11 GO-TO-Track

To approach a track

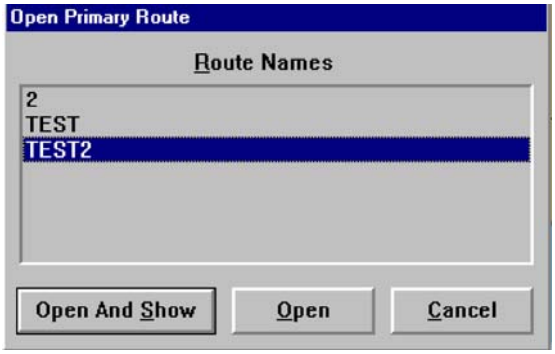
Before changing the operating mode make sure

- that the approximate heading position to the next track section is $\alpha \leq 60°$
- that the ship is within the track monitoring limits

To approach the track, the heading control operating mode of the NP2010/2020 or NP2015/2025, or manual steering, is recommended.

2.7 Loading a Route

Note:
If another Route is active you have to clear it.
Select menu “ROUTES→ CLEAR ROUTE” (see ECDIS Manual chapter 8.1.18).

	Indications	Remarks/Notes
On the ECDIS select menu “ROUTES → OPEN ROUTE”		
Select the route you want to open		
Select *Open* or *Open And Show*. Open And Show will center the display on an appropriate chart and the route centered on first waypoint.		

The following track parameters are defined:

- WOP circle
- Approach circle
- Maximum track deviation

2.8 Checks to be made before switching ON the Track Control

For correct functioning of the trackkeeping, faultless operation of the following systems and devices is required:

Steering gear and steering control system
Sensors and corresponding transmission from

- gyro compass
- magnetic compass
- log
- position sensor

2.9 Displaying the GO-TO-Waypoint of a Route

When you open the Steer to Track dialog box after creating or opening a route, ECDIS automatically selects the first valid waypoint in the route as the active waypoint. If you want to navigate to a different waypoint, you can do so by using the arrow keys. When you select the new waypoint, ECDIS checks to make sure it is a valid course line, then it circles the waypoint, redraws the course line, and updates the Information Panel. If it is not a valid course line, then ECDIS grays the dialog box, except the *Select Active Waypoint arrow* buttons, until a valid waypoint is selected. Selecting an active waypoint is very useful when you are navigating a long route. For example, suppose you are navigating a route from Seattle to Pusan and decide to stop in Prince Rupert. When you are ready to continue on to Pusan, open your route again, and then using the **Track Control** command, you can reassign the active waypoint and continue on the route.

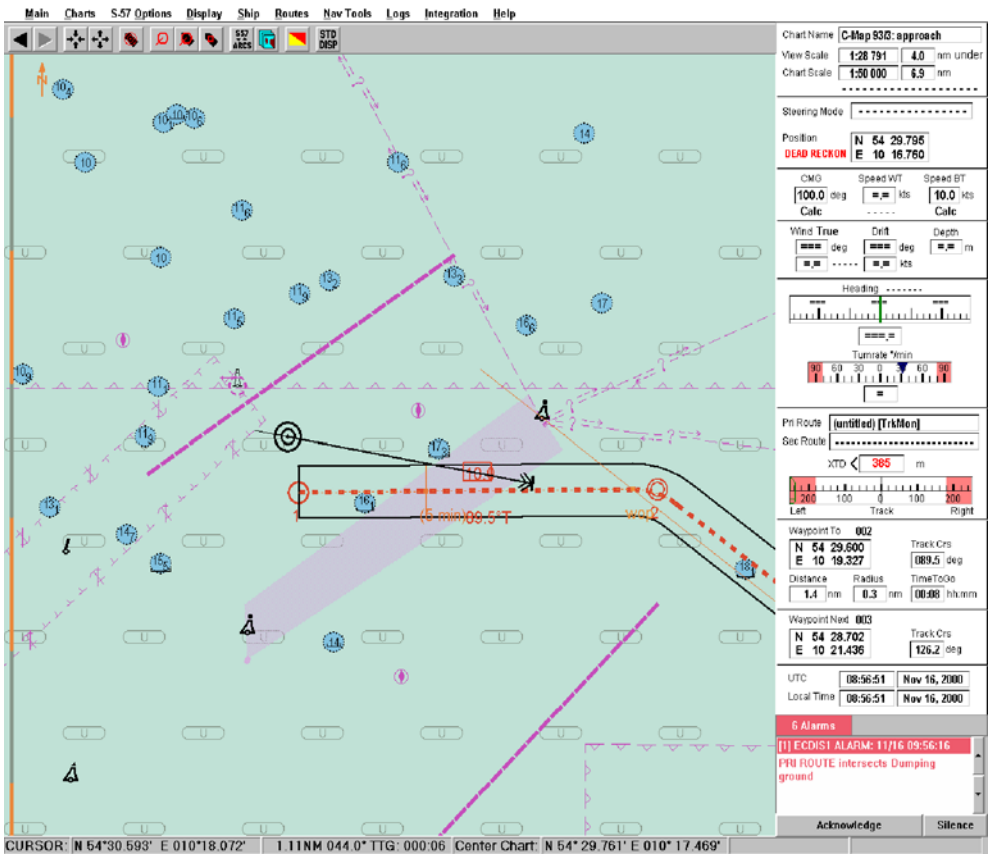


Fig. 1-12 Approaching the Track

2.10 Activating Track Control at ECDIS

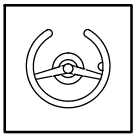
2.10.1 Approaching the Track

The track approaching manoeuvre needs some requirements to be kept:
GO-TO-Waypoint manoeuvre

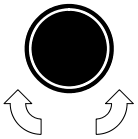
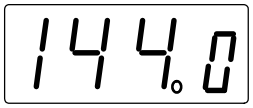
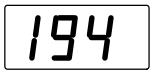
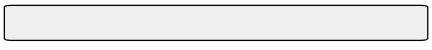
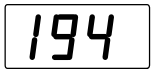
1) The TO-WPT has to be located in free water (see Fig. 1-10).
2) The **initial position** should be before the track and should be less than 10 nautical miles away.

GO-TO-Track manoeuvre (see Fig. 1-11)

Make sure, that these requirements are fulfilled when starting track control.

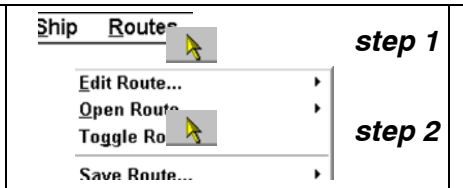
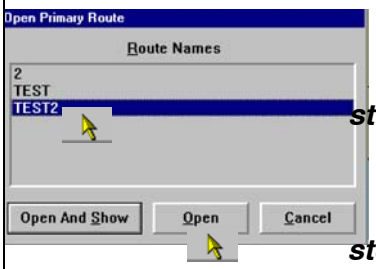
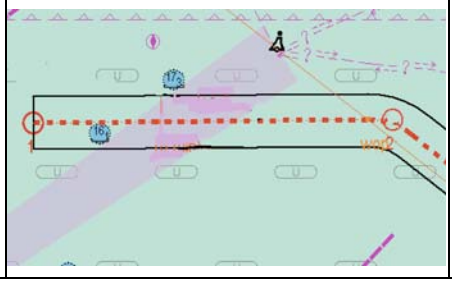
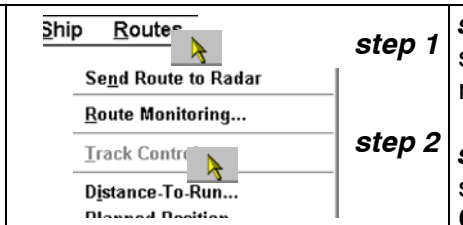
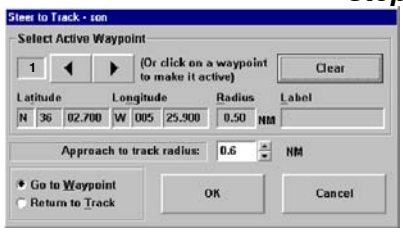
	Indications	Remarks/Notes
1 Approach by manual control		
		Approach the track until initial position and initial heading are reached.

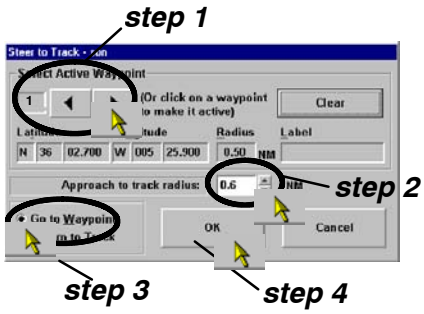
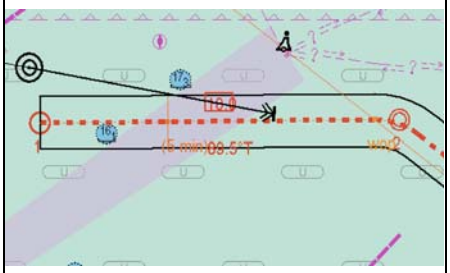
	Indications	Remarks/Notes
1 Approach by autopilot NP2010/20 or NP2015/25 heading control		
		Select **Autopilot** Approach the track until initial position and initial heading are reached.

	Indications	Remarks/Notes
2 Preselect preset heading		
	Heading  **PRESELECTED HDG**  Preset Heading Set	Turning the rotary knob results in that the desired preset heading appears within the **Preset Heading** display. A comment appears within the text line (for approx. 15s). The previous text is overwritten for this period. The LED of the Set key is flashing. The new preset heading must be acknowledged within approx.15s. If not acknowledged, the previous preset heading value, which remains valid, re–appears on the Preset Heading display after 15 s.
3 Acknowledge the preset heading preselection		
 Set	Heading   Preset Heading	The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

The system is now ready for further start Track Control procedure.
This can be done at ECDIS or in combination ECDIS and ARCP (see sections 2.10.2 and 2.11.2)

2.10.2 Activating Track Control, GO-TO-Waypoint Manoeuvre

	Indications	Remarks/Notes
1 Select the **Open Route** command from the menu bar **Routes**		
	 *step 1* *step 2*  *step 3* *step 4* 	***step 1*** select the Menu command **Routes**. ***step 2*** select the command **Open Route**. A dialog box appears with already created routes (primary or secondary). Take your choice. ***step 3*** select a route and click on *Open* (***step 4***). the route takes place in the chart display.
2 Select the **Track Control** command from the menu bar Routes		
	 *step 1* *step 2* *step 3* 	***step 1*** select the Menu commands **Routes** again. ***step 2*** select the command **Track Control**. A dialog box **Steer to Track** appears (***step 3***).

	Indications	Remarks/Notes
3 Select the **TO-WPT** (active waypoint)		
	 **Track Control** is activated 	Waypoint selecting per cursor. Move the cursor over the waypoint (**TO-WPT**) to which you want to navigate and press *left mouse* button. *Or* **step 1** Use the left or right arrow key for selecting the waypoint (**TO-WPT**). **step 2** Select a convenient approach radius. **step 3** Select **Go to Waypoint**. **step 4** Click on *OK*. **Track Control** is activated.

Notes:

During the operating mode of track control

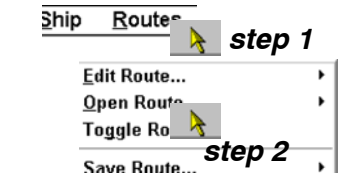
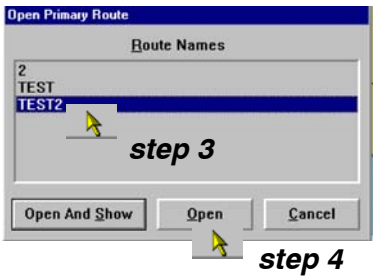
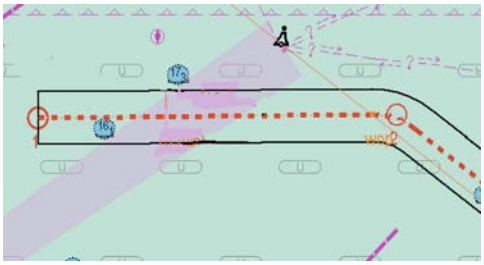
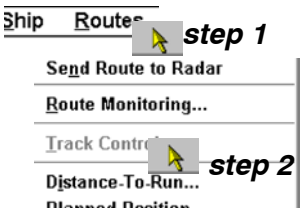
- The navigation parameter is set to “R.o.T.“ if radius has been activated. For track change manoeuvres, the NP2010/15 or /NP2015/25 takes the radius value planned at the ECDIS and calculates the necessary R.o.T. This R.o.T. cannot be varied on the operator unit of the autopilot.

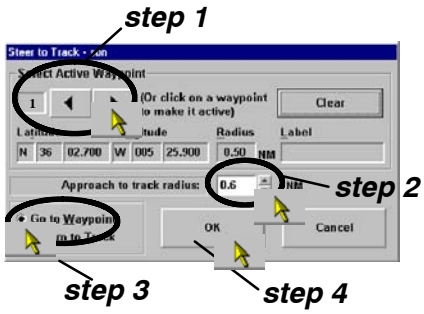
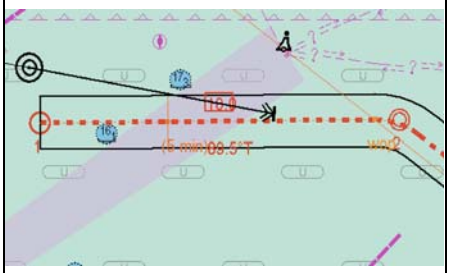
  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken. The selectable minimum radius is ships specific and is to be adjusted by the service engineer.

  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.

  Exception: If the track control is interrupted during a track turn ,in a fall back situation – the last R.o.T. value necessary to fulfil the manoeuvre will stay for heading control.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.
- The rudder limit setting is active during track control and may have influence to the desired radius if more rudder is needed. In this case the rudder limit should be increased.

2.10.3 Activating Track Control, GO-TO-Track Manoeuvre

	Indications	Remarks/Notes
1	Select the **Open Route** command from the menu bar **Routes**	
	  	***step 1*** select the Menu command **Routes**. ***step 2*** select the command **Open Route**. A dialog box appears with already created routes (primary or secondary). Take your choice. ***step 3*** select a route and click on *Open* (***step 4***). the route takes place in the chart display.
2	Select the **Track Control** command from the menu bar Routes	
	 ***step 3***	***step 1*** select the Menu commands **Routes** again. ***step 2*** select the command **Track Control**. A dialog box **Steer to Track** appears (***step 3***).

	Indications	Remarks/Notes
3 Select the **TO-WPT** (active waypoint)		
	 **Track Control** is activated 	Waypoint selecting per cursor. Move the cursor over the waypoint (**TO-WPT**) to which you want to navigate and press *left mouse* button. Or **step 1** Use the left or right arrow key for selecting the waypoint (**TO-WPT**). **step 2** Select a convenient approach radius. **step 3** Select **Go TO Track**. (within track limits). **step 4** Click on *OK*. **Track Control** is activated.

Notes:

During the operating mode of track control

- The navigation parameter is set to “R.o.T.“ if radius has been activated. For track change manoeuvres, the NP2010/15 or /NP2015/25 takes the radius value planned at the ECDIS and calculates the necessary R.o.T. This R.o.T. cannot be varied on the operator unit of the autopilot.

  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken. The selectable minimum radius is ships specific and is to be adjusted by the service engineer.

  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.

  Exception: If the track control is interrupted during a track turn ,in a fall back situation - the last R.o.T. value necessary to fulfil the manoeuvre will stay for heading control.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.
- The rudder limit setting is active during track control and may have influence to the desired radius if more rudder is needed. In this case the rudder limit should be increased.

2.11 Activating Track Control at ARCP (Option)

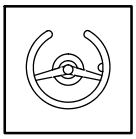
2.11.1 Approaching the Track

The track approaching manoeuvre needs some requirements to be kept:
GO-TO-Waypoint manoeuvre

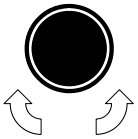
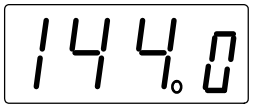
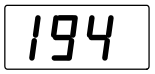
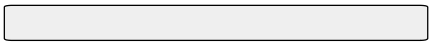
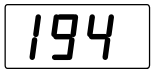
1) The TO-WPT has to be located in free water (see Fig. 1-10).
2) The **initial position** should be before the track and should be less than 10 nautical miles away.

GO-TO-Track manoeuvre (see Fig. 1-11)

Make sure, that these requirements are fulfilled when starting track control.

	Indications	Remarks/Notes
1 Approach by manual control		
		Approach the track until initial position and initial heading are reached.

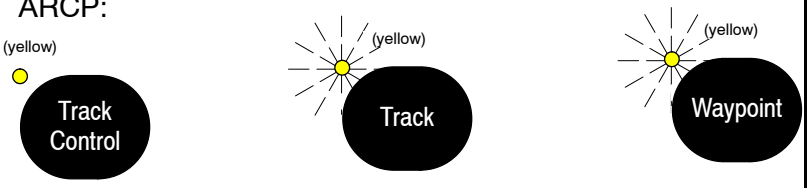
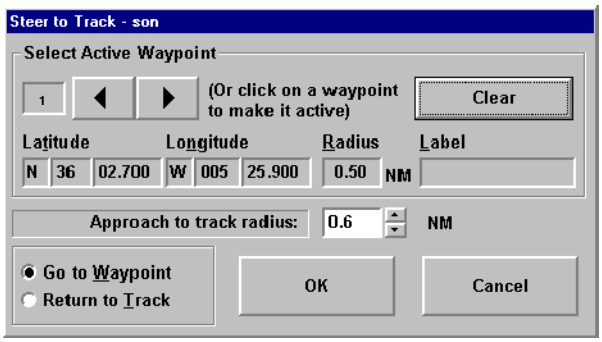
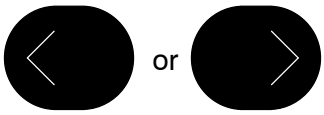
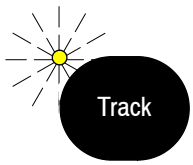
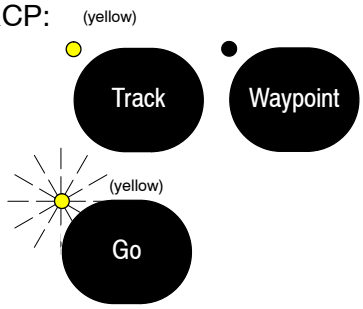
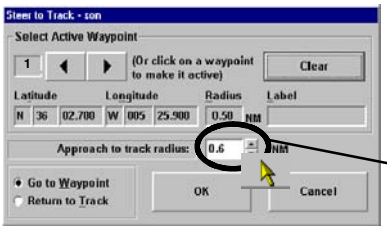
	Indications	Remarks/Notes
1 Approach by autopilot NP2010/20 or NP2015/25 heading control		
		Select **Autopilot** Approach the track until initial position and initial heading are reached.

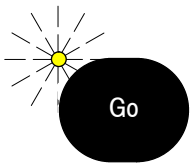
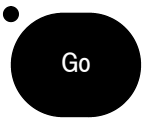
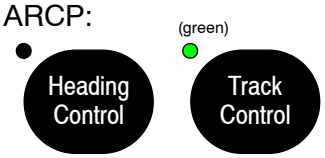
	Indications	Remarks/Notes
2 Preselect preset heading		
	Heading  **PRESELECTED HDG**  Preset Heading Set	Turning the rotary knob results in that the desired preset heading appears within the **Preset Heading** display. A comment appears within the text line (for approx. 15s). The previous text is overwritten for this period. The LED of the Set key is flashing. The new preset heading must be acknowledged within approx.15s. If not acknowledged, the previous preset heading value, which remains valid, re–appears on the Preset Heading display after 15 s.
3 Acknowledge the preset heading preselection		
 Set	Heading   Preset Heading	The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

The system is now ready for further start Track Control procedure.
This can be done at ECDIS or in combination ECDIS and ARCP (see sections 2.10.2 and 2.11.2)

2.11.2 Activating Track Control, GO-TO-Waypoint Manoeuvre at ARCP (Option)

	Indications	Remarks/Notes
1 Activate Heading Control		
AUTO-PILOT	Autopilot: Heading Control ARCP: (green) Heading Control, In Command	If the track is approached via manual steering, set steering mode selector switch to **AUTO.** Heading control is thus selected. ARCP passive. Operating mode of autopilot is indicated.
2 Activate the ARCP in front of ECDIS		
ARCP: Take Over	ARCP: (yellow) Set, (yellow) In Command	
ARCP: Set	ARCP: Set, (green) In Command, (green) Ready, (green) Heading Control	Acknowledge take-over. Operating mode of autopilot remains.

	Indications	Remarks/Notes
3 Select Track Control		
ARCP:	ARCP:  ECDIS Dialog Box:  Steer to Track - son Select Active Waypoint 1 (Or click on a waypoint to make it active) Clear Latitude Longitude Radius Label N 36 02.700 W 005 25.900 0.50 NM Approach to track radius: 0.6 NM Go to Waypoint Return to Track OK Cancel	
4 Select TO-WPT (active waypoint)		
ARCP: 		Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS
5 Select Type of Approach Maneuver here: "Go to Track"		
ARCP: 	ARCP: 	Indication in the Steer to Track dialog box at the ECDIS changes from "Go To Waypoint" to "Return to Track".
Select approach radius size  Steer to Track - son Select Active Waypoint 1 (Or click on a waypoint to make it active) Clear Latitude Longitude Radius Label N 36 02.700 W 005 25.900 0.50 NM Approach to track radius: 0.6 NM Go to Waypoint Return to Track OK Cancel		Select convenient approach radius

	Indications	Remarks/Notes
6 Acknowledge		
ARCP: 	ARCP: 	Check of the geometrical constellation of ship‘s position and requested track.
	ARCP: (green)  Autopilot:	Track control is started when the check of the geometrical constellation of ship‘s position and track is passed. The new calculated preset heading appears within the “Preset Heading” display of the autopilot. The ship starts turning.

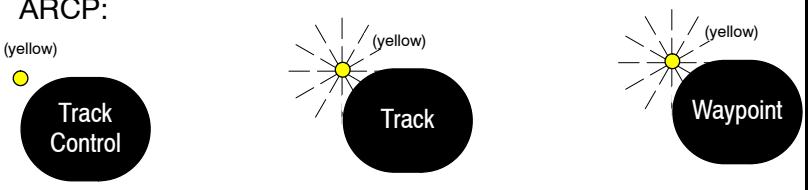
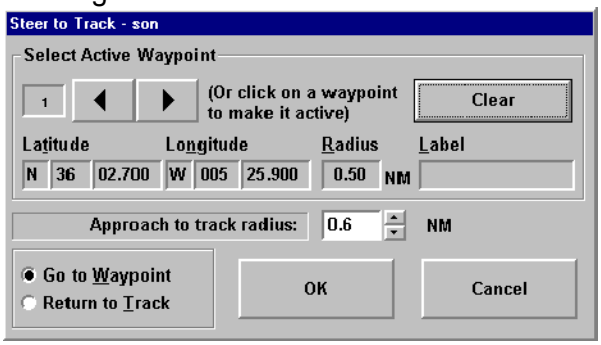
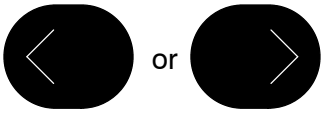
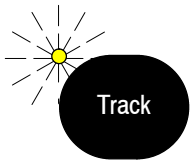
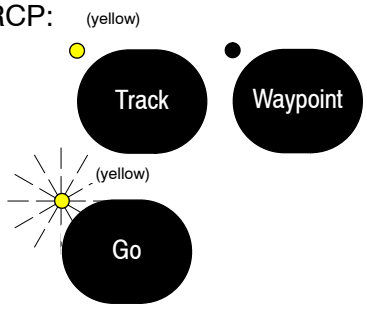
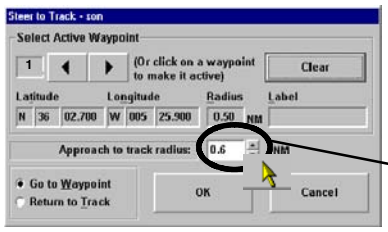
Notes:

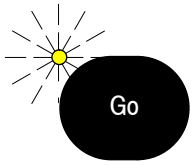
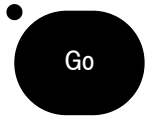
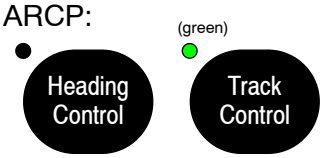
During the operating mode of track control

- The navigation parameter is set to “R.o.T.“ if radius has been activated. For track change manoeuvres, the NP2010/15 or /NP2015/25 takes the radius value planned at the ECDIS and calculates the necessary R.o.T. This R.o.T. cannot be varied on the operator unit of the autopilot.
  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken. The selectable minimum radius is ships specific and is to be adjusted by the service engineer.
  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.
  Exception: If the track control is interrupted during a track turn ,in a fall back situation – the last R.o.T. value necessary to fulfil the manoeuvre will stay for heading control.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.
- The rudder limit setting is active during track control and may have influence to the desired radius if more rudder is needed. In this case the rudder limit should be increased.

2.11.3 Activating Track Control GO-TO Track Manoeuvre at ARCP (Option)

	Indications	Remarks/Notes
1 Activate Heading Control		
AUTO-PILOT	Autopilot: Heading Control ARCP: (green) Heading Control, In Command	If the track is approached via manual steering, set steering mode selector switch to **AUTO.** Heading control is thus selected. ARCP passive. Operating mode of autopilot is indicated.
2 Activate the ARCP in front of ECDIS		
ARCP: Take Over	ARCP: (yellow) Set, (yellow) In Command	
ARCP: Set	ARCP: Set, (green) In Command, (green) Ready, (green) Heading Control	Acknowledge take-over. Operating mode of autopilot remains.

	Indications	Remarks/Notes
3 Select Track Control		
ARCP:	ARCP:  ECDIS Dialog Box: 	
4 Select TO-WPT (active waypoint)		
ARCP:  or		Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS
5 Select Type of Approach Maneuver here: ”Go to Track”		
ARCP: 	ARCP: 	Indication in the Steer to Track dialog box at the ECDIS changes from “Go To Waypoint” to “Return to Track”.
Select approach radius size 		Select convenient approach radius

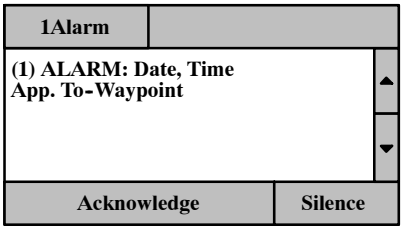
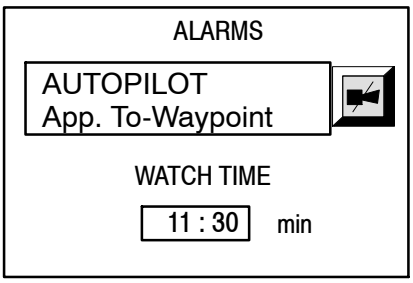
	Indications	Remarks/Notes
6 Acknowledge		
ARCP: 	ARCP: 	Check of the geometrical constellation of ship's position and requested track.
	ARCP:  Autopilot: Preset Heading	Track control is started when the check of the geometrical constellation of ship's position and track is passed. The new calculated preset heading appears within the "Preset Heading" display of the autopilot. The ship starts turning.

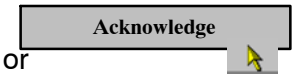
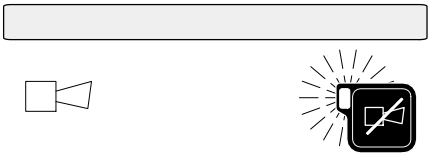
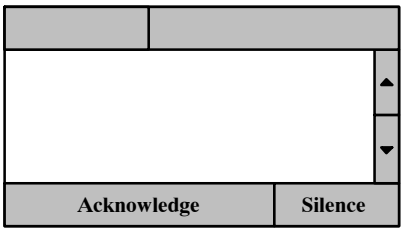
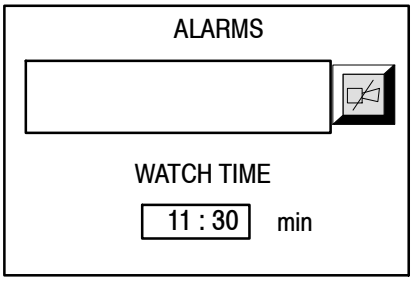
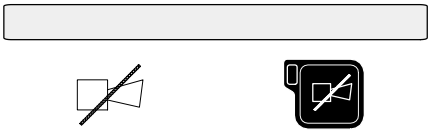
Notes:

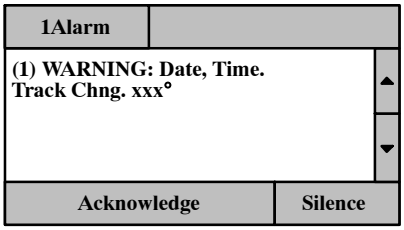
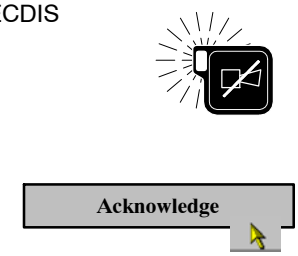
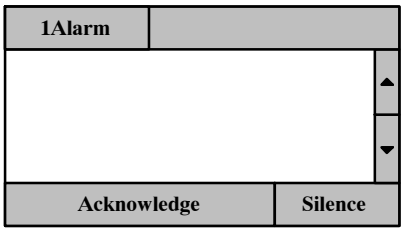
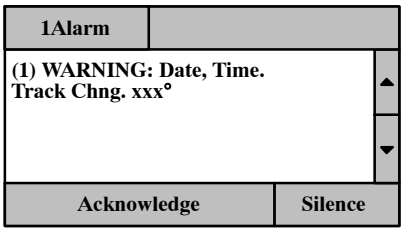
During the operating mode of track control

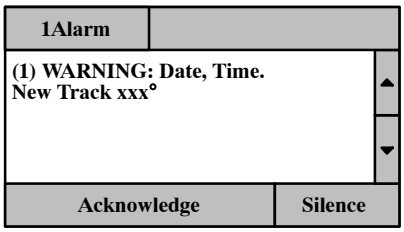
- The navigation parameter is set to "R.o.T." if radius has been activated. For track change manoeuvres, the NP2010/15 or /NP2015/25 takes the radius value planned at the ECDIS and calculates the necessary R.o.T. This R.o.T. cannot be varied on the operator unit of the autopilot.
  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken. The selectable minimum radius is ships specific and is to be adjusted by the service engineer.
  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.
  Exception: If the track control is interrupted during a track turn ,in a fall back situation – the last R.o.T. value necessary to fulfil the manoeuvre will stay for heading control.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.
- The rudder limit setting is active during track control and may have influence to the desired radius if more rudder is needed. In this case the rudder limit should be increased.

2.12 Track Change Manoeuvre

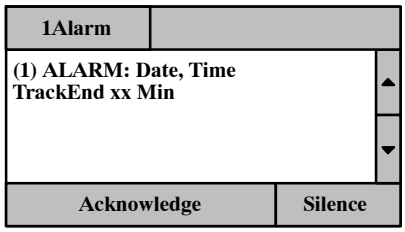
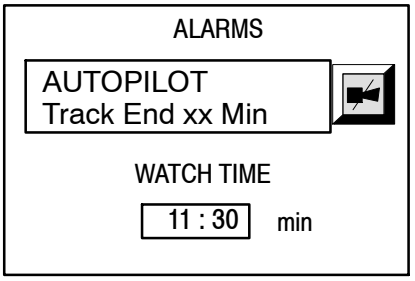
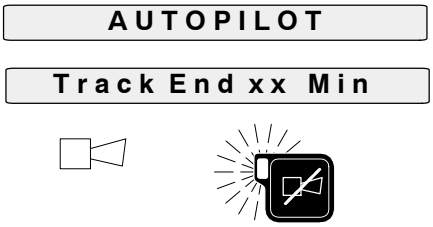
	Indications	Remarks/Notes
1 Alarm		
	Autopilot: **App. To-Waypoint** ECDIS:  **1Alarm** **(1) ALARM: Date, Time** **App. To-Waypoint** **Acknowledge** **Silence** NAUTOCONNING (Option):  ALARMS AUTOPILOT App. To-Waypoint WATCH TIME 11 : 30 min Conning alarm panel (Option): **AUTOPILOT** **App. To-Waypoint** 	Between 3 and 6 min. before the WOP. (Adaptable at ECDIS default is 6 min.)

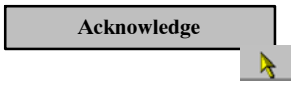
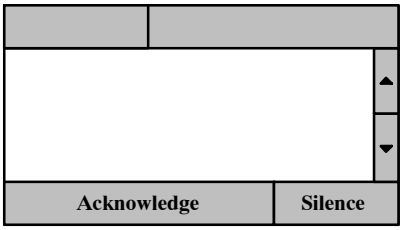
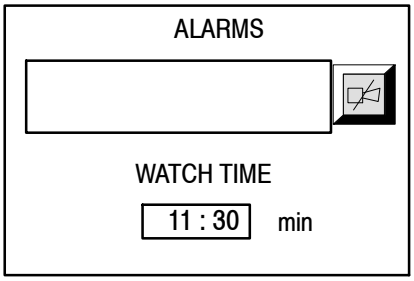
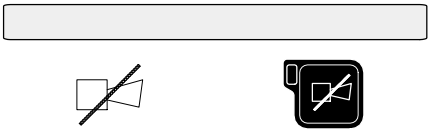
	Indications	Remarks/Notes
2 Acknowledge alarm		
Autopilot: ECDIS:  or NAUTOCONNING: or Operator unit NAUTOCONNING: or Conning alarm panel:	Autopilot:  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	

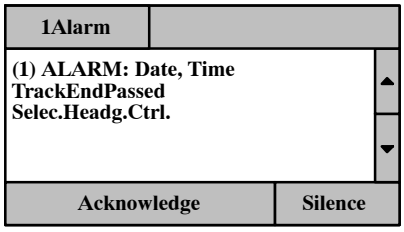
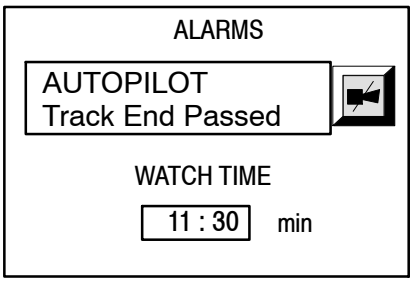
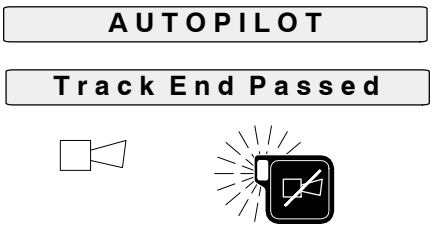
	Indications	Remarks/Notes
3 Warning		
	ECDIS:  	30s before the track change maneuver is started.
4 Acknowledge warning		
ECDIS  	ECDIS:  	
5 Track change maneuver starting		
	ECDIS:  	Indication when track change maneuver is starting. The track change maneuver is starting even if the operator did not acknowledge the previous alarms and warnings!

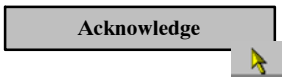
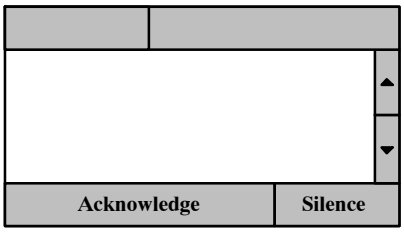
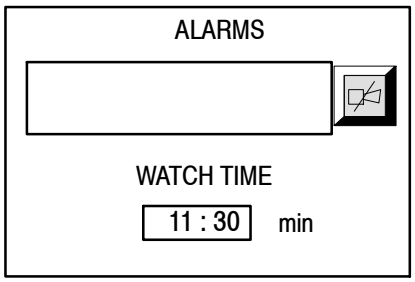
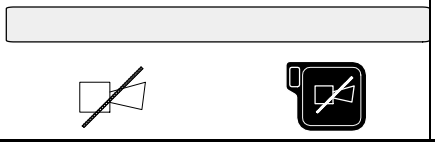
	Indications	Remarks/Notes
6 Track change manoeuvre		
	ECDIS:  	As soon as the ship has reached the new track section.

2.13 Track End

	Indications	Remarks/Notes
1 Alarm		
	ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option):  	xx minutes left to last way-point.

	Indications	Remarks/Notes
2 Acknowledge the alarm		
ECDIS:  or: NAUTOCONNING: or Operator unit NAUTOCONNING: or Conning alarm panel: 	ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	

	Indications	Remarks/Notes
3 Alarm		
	ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option):  	Last waypoint passed

	Indications	Remarks/Notes
4 Acknowledge the alarm		
ECDIS:  or: NAUTOCONNING: or Operator unit NAUTOCONNING: or Conning alarm panel: 	ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	The alarm comes up every 30 s until having changed-over to another operating mode, e.g. heading control or manual control.

Attention:

The system remains in “Track Control” on the last track course-line until a user changes-over to another steering mode.

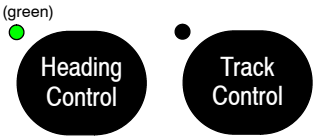
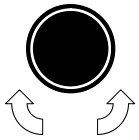
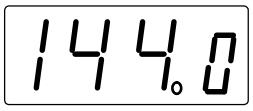
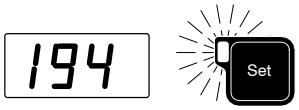
2.14 Interruption of Track Control by the User

In case of emergency (e.g. collision avoidance) interruption of track control is possible in several ways. The possibilities are listed from low to high level in the steering control hierarchy.

Overview:

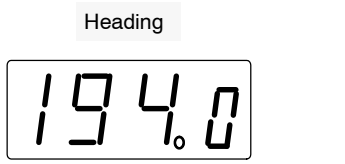
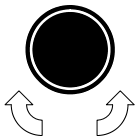
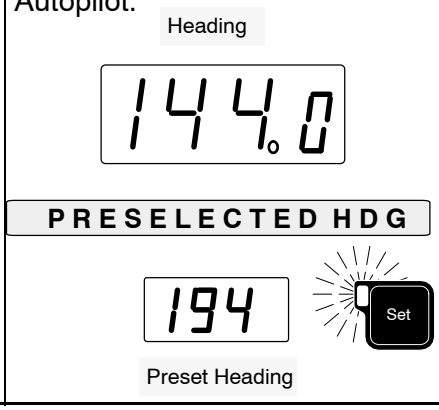
- Select **Heading Control** on the ARCP which is in command
- Select **Heading Control** on the Operator Unit Autopilot
- Actuate Override Tiller on the ARCP which is in command
- Change-over to Manual Control (FU Handwheel)
- Actuate Main Override Tiller (NFU)

2.14.1 Switch-over from Track Control to Heading Control at ARCP (Option)

	Indications	Remarks/Notes
1 Change-over to **heading control** on the ARCP		
ARCP:	ARCP: (green)  Autopilot:	The actual heading is taken as new preset heading.
2 Preselect new preset heading		
Autopilot: 	Autopilot: Heading  **PRESELECTED HDG**  Preset Heading	Turning the rotary knob results in that the desired preset heading appears within the “Preset Heading” display. The new preset heading must be acknowledged within approx.15s.
3 Acknowledge the preset heading preselection		
Autopilot:		The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

2.14.2 Switch-over from Track Control to Heading Control at Autopilot Operator Unit

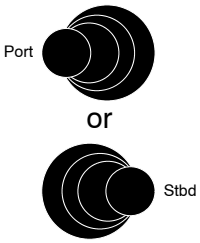
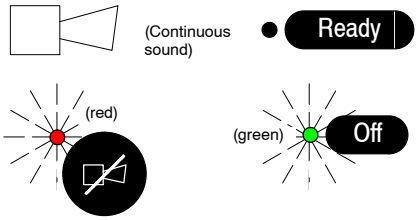
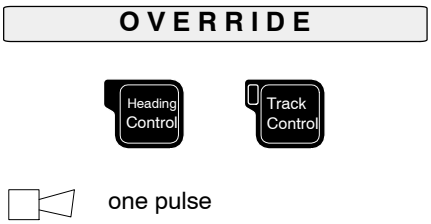
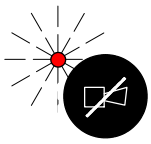
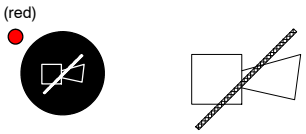
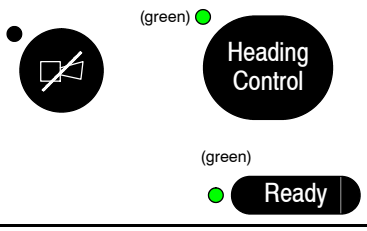
	Indications	Remarks/Notes
1 Change-over to heading control on the autopilot		
Autopilot:	Autopilot:  ARCP:	The actual heading is taken as new preset heading.
2 Preselect new preset heading		
Autopilot: 	Autopilot: 	Turning the rotary knob results in that the desired preset heading appears within the “Preset Heading” display. The new preset heading must be acknowledged within approx.15s.

	Indications	Remarks/Notes
3 Acknowledge the preset heading preselection		
Autopilot:		The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

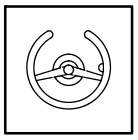
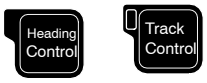
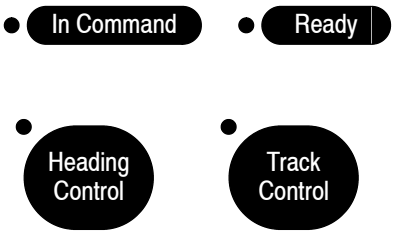
2.14.3 Switch-over from Track Control or Heading Control to Autopilot Override Mode at Autopilot Override Tiller at the ARCP (Option)

NOTE
ARCP Override Tiller is only ready for use if the ARCP is “in command”

	Indications	Remarks/Notes
1 Start override		
ARCP: 	ARCP:  Autopilot: 	The rudder moves in the pre-selected direction as long as the contact is made. The actual rudder angle is to be observed on a rudder angle indicator.
ARCP: 	ARCP: 	
2 End override		
ARCP:	ARCP: 	Heading control is active, independent of the operating mode before.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

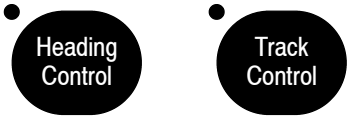
2.14.4 Change-over to Manual Control (FU Handwheel)

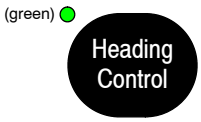
	Indications	Remarks/Notes
1	Change-over to manual control by changing over the operating mode on the steering mode selector switch.	
	Autopilot:  ARCP:  	Adjust rudder angle by means of the handwheel. The rudder is moved until it reaches the required angle set by the hand-wheel.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

2.14.5 Actuate Main Override Tiller (NFU)

(Option, not available in all system configurations)

	Indications	Remarks/Notes
1 Start override		
Actuate main override tiller	Autopilot: **OVERRIDE** Override Indicator: ARCP (Option):  	Adjust rudder angle by means of the tiller. The rudder position is changed as long as the contact is made. The actual rudder angle is to be observed on the rudder angle indicators.
Override indicator: 	Override indicator: 	

	Indications	Remarks/Notes
2 End override		
Override Indicator: 	Autopilot: Override indicator: ARCP: 	Heading control is active, independent of the operating mode before.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

2.15 Reactivating Track Control after user interruption

The reactivation of Track Control is the same procedure as performing a GO-TO-Track manoeuvre see section 2.10 or 2.11 in case of using ARCP (Option).

2.16 Interruption of Track Control in case of a Defect

In case of any failure of the system it is not necessary for the officer of the watch to react immediately. The system becomes degraded to the next lower steering control mode level and continues started manoeuvres as far as possible.

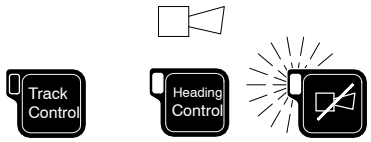
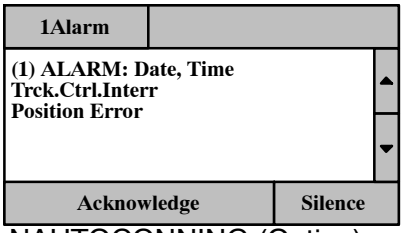
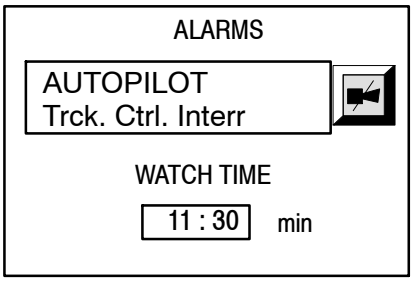
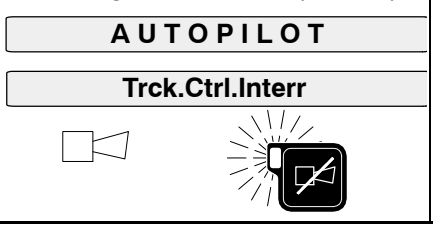
Note!
There is one exception from that.
In case of loosing the heading reference it is not possible for the system to continue the course of the preplanned track in a fall back mode.
In that case the present rudder angle is frozen, the rudder motion will be stopped (IMO requirement).
The operator has immediately to take over via Override Tiller or select Hand Steering Mode via Steering selector Switch.

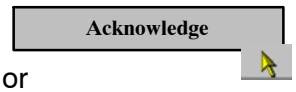
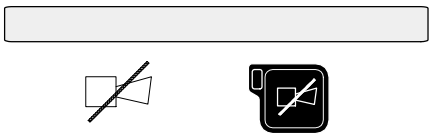
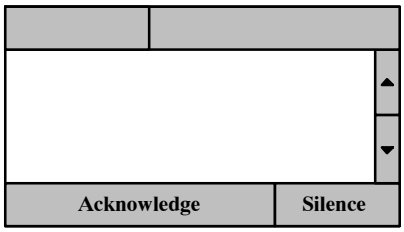
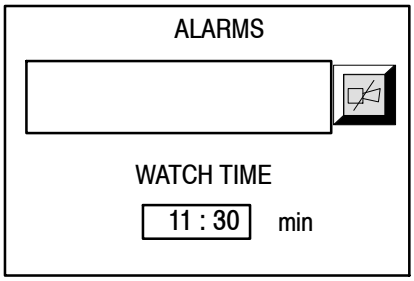
During **track control** mode two different phases are distinguished:
1) the ship is sailing on a straight track leg
2) the ship is in a track change manoeuvre

Interruption of track control leads to two different reactions depending on the phase the vessel is in, see the following Sections.
A summary is given section 2.17.

2.16.1 Interruption of Track Control During Sailing a Straight Track Leg

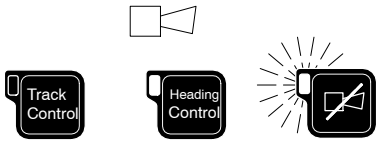
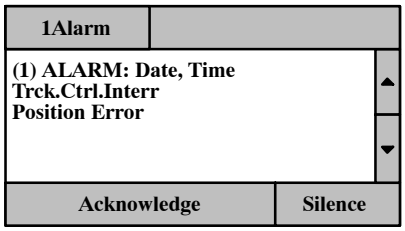
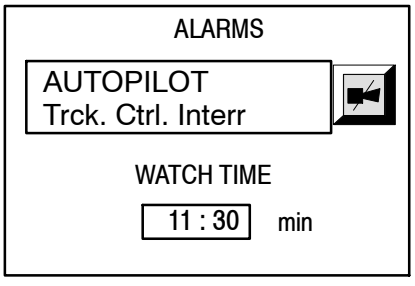
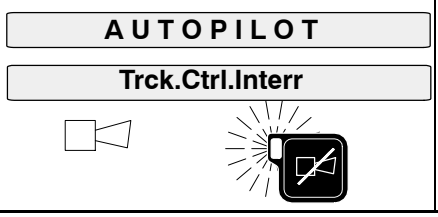
The track approach is finished. The vessel is on a straight track leg.

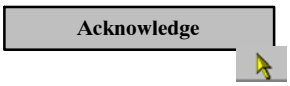
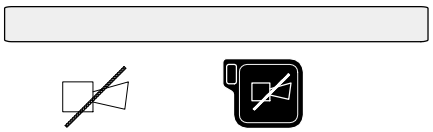
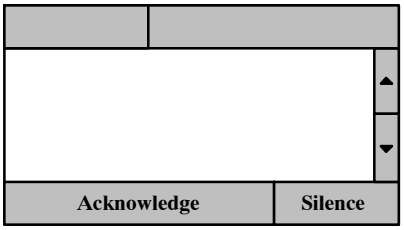
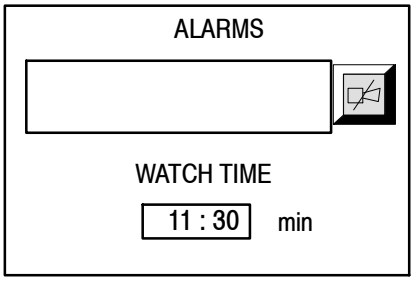
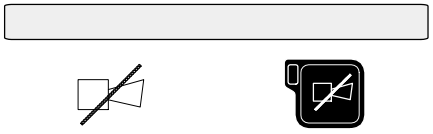
	Indications	Remarks/Notes
1 Alarm (e.g. No Position)		
	Autopilot: Nav Data Fail 1 Track stopped 2 Hdg Ctrl selected  ARCP (Option): ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	1. The operating mode changes from track control to heading control. 2. The actual heading is taken as the new preset heading.

	Indications	Remarks/Notes
2 Acknowledge alarm		
Autopilot: or ECDIS:  or NAUTOCONNING: or Operator unit NAUTOCONNING: or Conning alarm panel: 	Autopilot:  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	

2.16.2 Interruption of Track Control in a Track Change Manoeuvre

A track change manoeuvre is running.

	Indications	Remarks/Notes
1 Alarm (e.g. No Position)		
	Autopilot: 1 **Nav Data Fail** **Track stopped** 2 **Hdg Crtl. selected**  ARCP: ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	1. The operating mode changes from track control to heading control. Preset heading is the track–course of the new track. 2. The radius planned for the current track change maneuver is taken as maneuver parameter. 3. The track change maneuver has tried to be finished in **heading control** mode.

	Indications	Remarks/Notes
2 Acknowledge alarm		
Autopilot: or ECDIS:  or NAUTOCONNING: or Operator unit NAUTOCONNING: or Conning alarm panel: 	Autopilot:  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	

2.17 Summary failure situation

Interruption of track control	Steering mode	New preset heading	Navigation parameters
during track approach maneuver	Automatic change over to heading control	actual heading	parameters (and values) which were active before track control has been started
during sailing a straight track leg		actual heading	R.o.T. parameter and values which were active before track control has been started
during track change maneuver		new track course	R.o.T. with the value of the actual maneuver

Note:

There is one exception from that.

In case of loosing the heading reference it is not possible for the system to continue the course of the preplanned track in a fall back mode.

In that case the complaint with international regulations the rudder angle is frozen, the rudder motion will be stopped.

The operator has to take over via Override Tiller or select Hand Steering Mode via Steering selector Switch.

Attention:

If the current alarm is not acknowledged within 30s the “Back Up Officer Alarm” will be generated. The system activates a relay.

DEVICE	MESSAGES	SIGNIFICATION	PROBABLE CAUSE	EFFECTS on OPERATION	MEASURES
ECDIS	XTD GREATER THAN xxx M	During track control or track monitoring the current position is too far away from planned route	- XTE monitoring limit is too small. - Performance of the Track Control System not sufficient - Autopilot parameters not adapted - Problems with the steering gear or the steering control system	The preplanned cross track limit cannot be kept.	Increase XTE limit. XTE limit is user defined. Value can be adjusted in menu “Route” entry “Edit Route”. Check autopilot parameters. Check steering gear or steering control system.
ECDIS	GYRO ERROR	Timeout on interface lost HDG	Too much time has passed since last HDG telegram from GYRO	No Track Control possible	Check GYRO and/or HDG telegram
ECDIS	POSITION ERROR	NO position available	No data of position fixing system. Interface configuration	No Track Control possible	Check Nav interface, position input

ECDIS	GROUND SPEED ERROR	Timeout on interface, lost SOG data	No data of Speed Log. Interface Configuration	No Track Control possible	Check NMEA telegram VBW in interface Monitor. Check Sensor and communication cable to ECDIS
ECDIS	SPEED LOG ERROR	Timeout on interface, lost LOG data	Too much time has passed since last VBW (containing Longitudinal ground speed LOG). No data of Speed Log. Interface configuration	No Track Control possible	Check VBW telegram
ECDIS	WATER SPEED ERROR	Timeout, lost STW telegram	Too much time has passed since last good STW telegram	No Track Control possible	Check telegram and communication cable
ECDIS	WAYPOINT MISMATCH	Autopilot – ECDIS during track control a discrepancy between ECDIS and Autopilot data occurs	Interface problems	No Track Control possible	Stop Track Control. Check autopilot connection, if necessary restart ECDIS and Autopilot.

ECDIS	AUTOPILOT ERROR	Timeout, stop track control, in case of missing status from Autopilot	Used Autopilot: Check Status from Autopilot; if too much time has passed since last status ,message from the Autopilot then the ECDIS stops track control.	No Track Control possible	Check Autopilot, connection be-tween Autopilot and ECDIS. PANZSTA telegram
ECDIS	App. To-Waypoint	3 to 6 minutes left to turning ma-noeuvre	Approaching TO-Waypoint	----------	Acknowledge alarm
ECDIS	App. Next-Wpt	3 to 6 minutes left to next turning ma-noeuvre when still being in a turning manoeuvre	Approaching NEXT-Waypoint	----------	Acknowledge alarm
ECDIS	Track End x Min	x minutes left to track end	Approaching Track End	----------	Acknowledge alarm
ECDIS	Track End Passed Selec. Headg. Ctrl.	During track control the track end passed	----------	----------	The alarm comes up every 30s until having changed over to heading control or HAND control. Change over to heading control or HAND control

ECDIS	Control Mode Reset Remotely	Autopilot has interrupted Track control mode	Autopilot lost Gyro or Speed Information	No Trck Control possible	Check telegram and communication cable
ECDIS	Bearing to WPT > 60°	Actual heading and bearing TO-WPT (or TO Track) is more than > 60°	Actual heading and bearing TO-WPT (or TO Track) is more than > 60°	Track Control cannot be activated	Correct actual heading to lower than 60 degress
ECDIS	Out of Track Limits	Track limits are exceeded	Track limits are exceeded	Track Control cannot be activated	Use heading control to approach the track – ship must be within the limits
NP20x5	Speed missing Track stopped Hdg Ctrl selected	Timeout, lost speed source	Too much time has passed since last good speed information	No Track Control possible	Check telegram and communication cable
NP20x5	Gyro Ref: Err Track stopped Hdg Ctrl selected	Timeout, lost Gyro source	Too much time has passed since last good gyro information	No Track Control possible	Check telegram and communication cable
NP20x5	Track impossible	Lost Log or Gyro data	Too much time has passed since last good gyro information	Start of Track Control not possible	Check telegram and communication cable

> Warning!
> Automatic steering modes (course control, track control) may be used only, when the expectable steering accuracy complies with the traffic and navigational situation.
> Special care must be taken in confined and congested waters.

Starting Track Control

1) Checks to be made before starting track control

For correct functioning of the trackkeeping, faultless operation of the following systems and devices is required: Steering gear and steering control system, Sensors and corresponding transmission from gyro compass, magnetic compass, log, position sensor.

2) Load a route

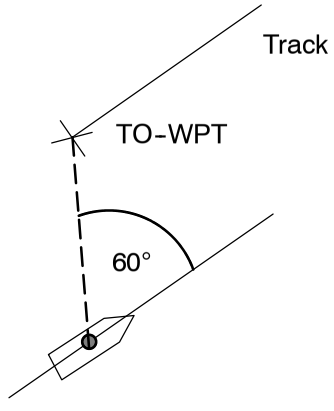
- On the ECDIS select menu WAYPOINTS → OPEN ROUTE. The Open Route dialog box appears.
- Select the route you want to open.
- Select ”Open” or “Open And Show”. “Open And Show“ will center the display on an appropriate chart and the route.

3) Approach the track

3a) Approach the track (GO-TO-WAYPOINT Maneuver, FROM-WPT undefined)

Approach the track by manual control (Handwheel) or by NP2010/15 or NP2020/25 heading control (course control) until initial position and initial heading are reached:

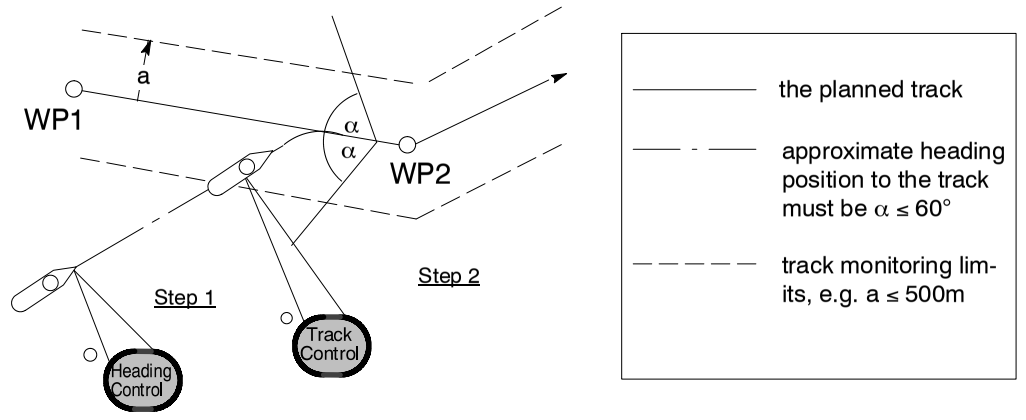
- The TO-WPT has to be located in free water
- The **initial position** should be ”before” the track and less than 10 nautical miles away



3b) Approach the track (GO-TO-TRACK Maneuver, FROM-WPT defined)

Approach the track by manual control (Handwheel) or by NP2010/15 or NP2020/25 heading control (course control) until initial position is reached.

The initial position must be within the predefined track limits.



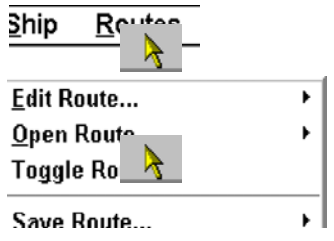
4) Activate Heading Control (if not in heading control)

If the track is approached via manual steering, set steering mode selector switch to **AUTO.** Course control (heading control) is thus selected.

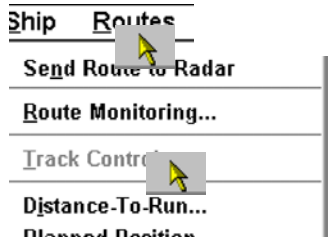
5) Activate the ARCP

- Take Over — On the ARCP press the **Take over** key.
- Set — On the ARCP acknowledge the take-over by pressing the **Set** key.

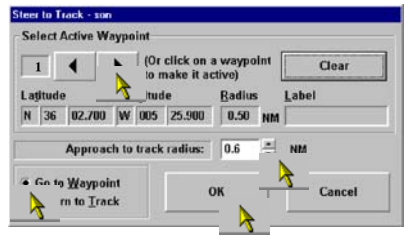
6) Activate at the ECDIS



Select the **Open Route** command from the menu bar **Routes**. Click on *Open*



Select **Track Control** command from the menu bar **Routes**



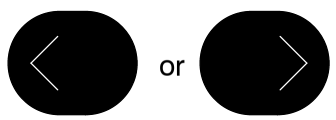
Select Waypoint
Select type of approach manoeuvre
Adjust approach radius
Activate **Track Control**

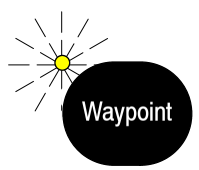
7) Start track control

7a) Start track control (GO-TO-WAYPOINT Maneuver, FROM-WPT undefined)

-

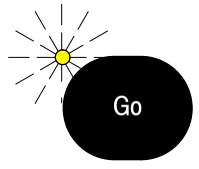
On the ARCP press the **Track control** key. On the ECDIS the Steer to Track dialog box appears.

-  or
On the ARCP select first TO-WPT (active waypoint) by pressing the **<** or **>** key. Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS.

- 

On the ARCP select "Go to Waypoint" by pressing the **Waypoint** key.

- Check approach radius at ECDIS dialog box.

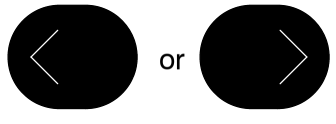
- 

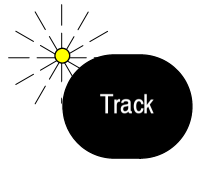
Acknowledge stat of Track Control by pressing **Go** key at ARCP. Track control is started when the check of the geometrical constellation of ship's position and track is passed. The new preset heading, which is needed to approach the track is calculated and displayed in the Set Course display of the NP2010/15 or NP2020/25.

7b) Start track control (GO-TO-TRACK Maneuver, FROM-WPT defined)

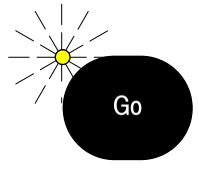
-

On the ARCP press the **Track control** key. On the ECDIS the Steer to Track dialog box appears.

-  or
On the ARCP select first TO-WPT (active waypoint) by pressing the **<** or **>** key. Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS.

- 

On the ARCP select "Go to Track" by pressing the **Track** key.

- 

Acknowledge stat of Track Control by pressing **Go** key at ARCP. Track control is started when the check of the geometrical constellation of ship's position and track is passed. The new preset heading, which is needed to approach the track is calculated and displayed in the Set Course display of the NP2010/15 or NP2020/25.

<u>Normal Track Change Maneuver</u>

During track change manoeuvre the preset heading for the turn is changing. It is updated cyclically in the Set Course display of NP2010/15 NP2020/25.

<u>Interruption of Track Control by the User and Reactivating Track Control</u>

In case of emergency (e.g. collision avoidance) interruption of track control is possible in several ways. The possibilities are listed from low to high level in the steering control hierarchy.

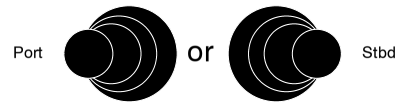
A) Select Heading Control on the ARCP

Change-over to heading control by pressing the **Heading Control** key at the ARCP.
The actual heading is taken as new set course (preset heading).
Reactivating track control is the same procedure as starting track control !

B) Select Heading Control on the Operator Unit Autopilot

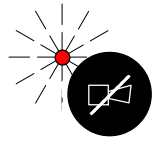
Change-over to heading control by pressing the **Course Control** key at NP2010/15 or NP2020/25 operator unit.
The actual heading is taken as new set course (preset heading).
Reactivating track control is the same procedure as starting track control !

C) Actuate Override Tiller on the ARCP

- 

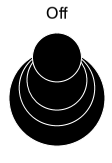
Move the lever of the override tiller to port or starboard at the ARCP. The rudder moves in the preselected direction as long as the contact is made. The actual rudder angle is to be observed on a rudder angle indicator.

- The ARCP buzzer sounds continuously.

- 
Acknowledge the alarm by pressing the **Acknowledge** key at the ARCP.

- The warning **OVERRIDE** appears in the autopilot display.

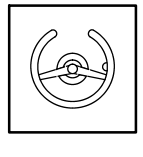
1x The buzzer sounds once.

- 

To end override move the lever of the override tiller at the ARCP to Off. Heading control is active, independent of the operating mode before.

Reactivating track control is the same procedure as starting track control !

D) Change-over to Manual Control (FU Handwheel)


Change-over to manual control by changing over the operating mode on the steering mode selector switch. Adjust rudder angle by means of the handwheel. The rudder is moved until it reaches the required angle set by the handwheel.
Reactivating track control is the same procedure as starting track control !

E) Actuate Main Override Tiller (NFU) (Option)

- Actuate main override tiller. Adjust rudder angle by means of the tiller. The rudder position is changed as long as the contact is made. The actual rudder angle is to be observed on the rudder angle indicators.
- The warning **OVERRIDE** appears in the autopilot display.

  1x The buzzer sounds once.
- On the override indicator the MANUAL key lights up and the buzzer sounds continuously.
- On the override indicator acknowledge the alarm by pressing the **MANUAL** key.
- To end override on the override indicator press the **AUTO** key.

Heading control is active, independent of the operating mode before.
Reactivating track control is the same procedure as starting track control !

Interruption of Track Control in Case of a Defect

In case of any failure of the system it is not necessary for the officer of the watch to react immediately. The system becomes degraded to the next lower steering control mode level and continues started maneuvers as far as possible. **Exception: Loss of heading sensors.**

During track control mode two different phases are distinguished:
A) sailing a straight track leg
B) track change maneuver

The interruption of track control leads into two different reactions depending on the phase the vessel is in, see the following Sections.

A) Interruption of Track Control During Sailing a Straight Track Leg

The track approach is finished. The vessel is on a straight track leg.
In the autopilot display, e.g. **Track stopped** **Hdg Ctrl. selected**
appears.
The buzzer sounds continuously.

Acknowledge the alarm by pressing the **Acknowledge** key at autopilot operator unit..

The operating mode changes automatically from track control to heading control (course control).
The actual heading is taken as the new set course (preset heading).

B) Interruption of Track Control During Track Change Maneuver

A track change maneuver is running.
In the autopilot display, e.g. **Track stopped** **Hdg Ctrl. selected**
appears.
The buzzer sounds continuously.

Acknowledge the alarm by pressing the **Acknowledge** key at autopilot operator unit.

The operating mode changes automatically from track control to heading control (course control).
The track course of the next track section is taken as the new set course (preset heading).
The radius planned for the current track change maneuver is taken as maneuver parameter.
The track change maneuver is tried to be finished in heading control mode.

Attention:
If the alarm will not be acknowledge within 30s the “Back Up Officer Alarm” will be activated.

Track End

In general all alarms are indicated on ECDIS,. It is also displayed at NAUTOCONNING and Conning alarm panel if that option is available.
Alarms can be acknowledged on ECDIS. It can also be acknowledged at NAUTOCONNING and Conning alarm panel, if that option is available.

Attention:
The system remains in “Track Control” on the last track course-line until a user changes-over to another steering mode.